THE

Gauger and Measurer's

Companion:

BEING

A Compendious way of Gauging *Superficies* and *Solids*; with the Reasons of most *Multiplicators* and *Divisors* used in *Mensuration*, and all difficult Points made plain and easy. With a way to Gauge all Quantities under a Gallon.

Also, a brief Description of the *Gauge Point* for Ale and Wine Gallons, with a Direction to find the same, and the Content of a Circle in all its parts. The exact method of Measuring Land, Board, Glass, Pavement, Stone, be it of what form soever, Together with a Globe and Round Timber, both Decimally and Vulgarly, with useful Tables. A Table of *Cylinders*, and a Treatise of Weights and Measures.

To which is added, at the request of some Gentlemen, a true method for Brewing strong Ale in *London*, as well and good as at any place in the Kingdom, with Directions for Clarifying any Ale, be it never so thick, in a few Hours. With Thirty Cuts.

By *JAMES LIGHTBODY*, Philomath.

London, Printed for *John Everingham*, at the *Star* in *Ludgate-street*. 1694.

Price 1 s. 6d.

TO THE

HONOURABLE

Sir *Stephen Evance*, Kt.

And the Worſhipful

William Strong, Eſq;

Commiſſioners of Their Majeſties Revenue of Excile in the Kingdom of *England*, &c.

This ſmall Treatiſe of Gauging *is Humbly Dedicated by*

Your Obedient Servant

James Lightbody

THE

PREFACE.

THe only intent of the enſuing Treatiſe, is, to be a ſhort and plain direction to thoſe who are, or intends to be, concern'd in Gauging or Meaſuring. I firſt deſigned it for a private uſe, but it now ſhows it ſelf in Pub-

lick, on presumption it may help the young Gauger *to discharge his Duty faithfully to his Masters.*

I will not be tedious in Prefacing it, only it recommends it self to thee in a mean Stile, my main aim being to make the Art plain and easy to the meanest Capacity, so that the Learner may not be choak't with Cramp and hard Terms of Art: It is adapted chiefly for the use of

the

the Learners, *and not the* Learned.

I am not curious or ſolicitous to think how it may go down with a ſort of men whoſe Cenſures are more plentiful than their good Works: But the ſober and ingenuous Artiſt, who finding a fault in another man, ſtrives to amend it in himſelf.

Had I not been prevail'd on by ſome ingenuous men con-

concern'd in the Revenue of Excise in Yorkshire, *where I was a* Gauger, I *should not have exposed my self in Print: But whatever the Critick say, the honest Artist, I am perswaded, will not deny, that it is Compendious, and* clear *for the* Learner; *So hoping it may be* first tried *before it be* Condemned. I *shall conclude, wishing the* learner may read what he understands, and understand what he reads, *that so he*

may

may become a Proficient. is the unfeigned desire of thy faithful Friend, and Well-wisher.

J. L.

THE

The Contents.

CHAP.

THE

ERRATA.

Page 34. line 4. for *half the arch*, read *two thirds*.
36. l. 18. for *half the altitude*, r. *one third*. p. 84. l. 2.. *Round*, r. *Broad*. p. 102. l. 19. f. *by* r. *of*.

THE Gauger and Measurer's COMPANION, &c.

Of Decimal Arithmetick.

BEfore any Man attempt to Learn any thing of *Gauging*, he must be sufficiently qualified in *Decimal Arithmetick*, or at least understand *Addition*, *Substraction*, *Multiplication* and *Division*; wherefore I shall here set down such easy and intelligible Directions, that a mean Capacity may apprehend them; and by a little Industry, attain to Perfection.

First, A *Decimal Fraction* is that whose Denomination is a Unit with *Cyphers*, as $\frac{1}{10}$. $\frac{10}{100}$. $\frac{614}{1000}$. they are always written without their Denominators, with a Point or Prick before them,

them, or betwixt them, and the whole Number as .5 .52 .653 .4563. You muſt always reckon them one place more than they are, or reckon the Pick for one place: For the foregoing Figures are expreſt thus, .5 of ten, or .5 tenths, .52 of an hundred, .653 of a thouſand, *&c.*

Secondly, As *whole Numbers* increaſe by tens from the left to the right, ſo *Decimals* decreaſe by tens, as you may ſee in the following Example.

·5 5 5 5 5 5

Primes Seconds Thirds Fourths Fifths Sixths Sevenths

The firſt of theſe Figures is .50, and the ſecond is but .5 ſo that the firſt isten times more than the ſecond, and the ſecond ten times more then the third, and ſo on; or thus, .15, that is, one *Prime* and 5 *Seconds*, the 5 *Seconds* is the half of one *Prime*; if there was 9. thirds added to it, then it would want but one third of 6 .*Seconds.*

Addition

Addition of Decimals.

Addition of *Decimals* is the same as that of *whole Numbers*, only observe to place *whole Number* under *whole Number*, and *Decimal* under *Decimal*, in right order and Denomination.

Example.

72.5	103.42
33.2	205.63
54.3	10.50
103.4	15.33
67.6	106.31
Sum 331.0	441.19

Subſtraction of Decimals.

Subſtraction of *Decimals* is all one with that of *whole Numbers*, only placing the figures of the same denomination under one another, as follows.

Example.

From 215.36	From 365.262
Sub. 123 27	Sub. 234.130
Rem. 092.09	Rem. 131.132

Multiplication of Decimals.

Multiplication of *Decimals* is also the same of *whole Numbers*, only you must prick as many Figures off to the right-hand, as there is *Decimals* in the *Multiplicator*, and *Multiplicand.*

I. *Example.*

A mixt number.

365.32 Multiplicand.
5.6 Multiplicator.

219192
182660

2045.792 Product.

You see in this Example there is two *Decimals* in the *Multiplicand*, and one in the *Multiplicator*, therefore I have prickt off 3 *Decimals*, and all the rest are *whole Numbers.*

II. *Ex-*

II. *Example.*

6.243235
.23 } A mixt Number by a *Decimal.*

18729705
12486470

1.43594405

Here is 8 *Decimals* in the 2 *Numbers*, therefore I prick off as many.

III. *Example.*

Of a Decimal by a Decimal.

3d	4th
.3632	.95321
.23	.93
10893	285963
7264	857889
.083536	.8864853

In the 3d *Example* the *Product* is a Figure short of the *Number* of the *Multiplicator* and *Multiplicand*, by reason the Primes are under .5, for 5 Multiplies any number into 10. above an Unit, as you may see in *Example* the

4th. where the Primes are .9, the Product is equal in number of Figures to the *Multyplyer*, and *Multiplicand*. So in the foregoing work where it wants of the number of places, you are to supply it with a Sypher before the figures in the Product.

Diviſion of Decimals.

Diviſion is the moſt Intricate Rule of all, tho the manner of working is the ſame as in the *whole Numbers*; the only difficulty is to find the Value of the *Quotient*. The general Rule is when your *Diviſion* is over, you are to prick off ſo many *Decimals* to the right hand in the *Quotient*, as will make theſe in the *Diviſor* equal in Number to thoſe the *Dividend*; as in the following *Example* I will make clear.

I. *Divide a mixt Number, by a mixt Number.*

```
324)  64.326  (.19
      3192
       2766
        174
```

Here you ſee there is three *Decimals* in

in the *Dividend*, and one in the *Divisor*, so I make that one in the *Divisor*, with the 2 in the *Quotient*, equal in Number to the 3 in the *Dividend*.

II. *Example.*

Divide a mixt Number by a Decimal.

```
.325) 53.62321 (161.19
      2012
       623
       2982
         571
         246
```

III. *Example.*

Divide a Decimal by a Decimal.

```
   1st.                    2d.
.05) .900 (18.0    .0005) .9000 (1800.
     40                     40
      00                     000
```

You see here in the 1st of the foregoing questions, I divide .900 by .05 and the Quotient I find to be 18.0, there being two *Decimals* in the *Divisor*, I prick off one in the Quotient to make

them equal with thoſe in the *Dividend*. And in the ſecond queſtion, the *Decimals* in the *Dividend* are equal to thoſe in the *Diviſor*, therefore I need prick off none in the Quotient, but let it remain a *whole Number*.

Perhaps the Learner may ſtartle to ſee a *whole Number* in the *Quotient*, and *Decimals* in both *Diviſor* and *Dividend*, but I ſhall in a few words make it Plain to him.

In the firſt queſtion I divide 900 by .05, that is, 9 *Primes* by 5 *Seconds*. The queſtion is ſtated in words thus. I deſire to know how often .5 *Seconds* in .9 *Primes*; the anſwer is 18. times; for there is 18. times .5 *Seconds* in .9 *Primes*; if you Multiply 18. by .5, the Product is 9.0.

If it ſo fall out that there is not ſo many Figures in the *Quotient* as will make theſe in the Diviſor equal in Number to thoſe in the Dividend, then you muſt prepone Cyphers before the *Quotient* to the left hand, as in this Example.

4) .13779 (.03444

CHAP. I.

Of Geometrical Obſervations. *The* Area *of* Unity, *and the uſe thereof. The deſcription of the* Gauge Point, *and the Square thereof How found, and the uſe of them. The reaſon of ſome material things in* Gauging.

IT is very neceſſ ry that every *Gauger* underſtand *Geometrical Quantities*, that they may know the true Application and Uſe of them in all Caſes, *viz.*

1. A *Line* hath only length, and neither breadth nor thickneſs. It is Commenſurable by a Line of *Inches*, *Feet*, *Poles*, *Furlongs*, or *Roods*, &c.

2. A *Superfice* hath length and breadth, but no thickneſs. It is commenſurable by *Superficial-Square Inches*, *Feet*, *or Yards*, &c.

3. A *Solid* hath length, breadth and thickneſs. And is Commenſurable by ſolid *Inches*, *Feet*, *or Yards*, &c.

To *Square* any Number, is to Multiply it, in, or by it ſelf, and the Pro-

Product is the Square of that Number.

As if you would desire to know the Square of 12, you Multiply 12 by 12, and the Product is 144, which is the Square of 12.

Also if you would know the *Cube* of any Number, you are to Multiply that Number by it self, and the Product by that Number again, and the last Product is the *Cube*. As if you would desire to know the *Cube* of 12, you Multiply 12 by 12, and the Product 144 as before, by 12, and the last Product is 1728, which is the *Cube* of 12.

So that if you Multiply the *Square* of any number by the *Root*, which is the Number before it be Multiplied in it self, you have the *Cube*.

Of the Area of Unity.

All Artists know that this is very material in *Mensuration*, either *Superficial* or *Solid*, therefore I thought fit to insert it here in this small *Epitome* of *Mensurations*: And for as much as the *Area* of *Unity* is of great use in *Gauging*, it is very convenient that the Learner should first know how to find it,

it, and then know the Uſe and Application of it; which I ſhall do in as plain and intelligible a manner as I can.

To find the Area *of* Unity, *or the Superficial Content of a Circle whoſe* Diameter *is one Inch.*

Multiply ½ the *Circumference*, by ½ the *Diamiter*, and the Product is the Anſwer.

Example.

The *Diamiter* being one Inch the *Circumference* by the *Rule of Proportion*, As 7 is to 22, is 3.14159

The Circumference is ——	3.14159
The Diameter is —— ——	1.00000
½ The Circumference — —	1.57079
½ The Diameter— —— ——	.5
The Area of Unity is —— —	.785395

The Square of any *Diamiter* being Multiplied by this *Area*, the Product will be the *Square Inches* contain'd therein; by reaſon that *Unity* is the ſmalleſt *Integer*, whoſe half being Multiplied into half its Circumference, the Product muſt needs be a proper

proper Multiplicator to Multiply the Square of a greater Diameter by, to bring out the *Superficial Area* in *Inches*.

I shall here shew you its Operation, in Multiplying the Square of a Diameter by it, and dividing the Product by the *Cubical Inches* in an Ale Gallon, and it will produce the same Area that 359, the Square of the *Gauge-point* does.

Example.

A Circles Diameter is —— 80
80

6400

The Area of Unity .78539

57600
19200
32000
51200
44800

282) 5026.49600 (17.82445
2206
2324
689
1256
1280
1520
110

The

The *Proof* of the foregoing Queſtion is by Dividing the Square of the Diameter by 359.10536 being the Square of the 18.95, called the *Gauge Point*; but I ſhall here, for brevity's ſake, leave out the *Decimals*, and only divide by 359, being nigh enough in Practice.

Example.

80
80

359) 6400 (17.8 *Equal to the former.*
2810
2970
98

I ſhall in the next place, give you the Deſcription of the *Gauge Point*, what it is, and how found, *viz.*

It is the *Diameter* of a Circle whoſe *Area* is 282, being the Exchequer *Inches* in an Ale Gallon, and the ſame of 231, being the *Cubical Inches* in an Wine Gallon.

It is found to be 18.95 by dividing 282, by .78539, the *Area* of *Unity*. Or 17.15 for Wine, by Dividing 231 by

by the ſame Number, and the Square Root of the Quotient is the Anſwer.

Example.

```
.7853)  282 000  (359.105
         46410
          71450
           8430
            37700
             6288
```

Here you ſee the Remainder is above half the Deviſor, therefore I make the laſt Figure in the *Quot.* one more.

```
          .  .  .
        359.10, &c.  (18.95
2)        259
        224
36)       3510
          3321
378)       18900
           15136
           3764
```

Here likewiſe the Remainder is above half the Diviſor, therefore I make the laſt figure in the *Root*, one more.

Square

Square the *Gauge Point*, and Multiply the Square of it by the *Area* of *Unity*, and the last Product will be the *Cubical Inches* in an Ale Gallon.

Or if you Square 17.15, the *Gauge-Point* for Wine, and Multiply by the *Area* of *Unity*, the Product will be 231, &c.

Example.

18.95
18.95

9475
17055
15160
1895

359.1025 *The Square of the G. Point.*
.7853 *The Area of Unity.*

10773075
17965125
28908200
25137175

282.137 19325 *The Cubical Inches in an Ale-Gallon.*

It

It is no leſs than fit that every Gauger ſhould know the *Reaſons* for every thing they do; to the end whereof I ſhall endeavour as nigh as poſſible, to ſhew you the Reaſons of ſome material things in *Gauging* of *Circles*.

Firſt, *Why* 359 *is the Diviſor, to find the Area of a Circle.*

Anſ. Being the *Gauge-Point*, is always the Diameter of any thing, whoſe Square Multiplied by the *Area* of *Unity*, produces the Content, or 282, the Square of the *Gauge Point* 359. muſt needs be a proper Diviſor to divide the Square of a greater Diameter by, to find the *Area*, in ſolid or ſquare Gallons of Ale.

1077 Being the *Triple Square* of the *Gauge Point*, muſt needs be the proper Diviſor for the finding the *Area* of 3 Circles (as the finding the Content of a Cask at one Working) the Rule is to the double Square of the Bong, add the Square of the *Head* (which is 3 Circles in all) and Divide the Product by 1077, and the quotient is the *Area*.

Why is 3.14 *a Multiplier to Multiply the Diameter by to find the Circumference.*

Answ. 3.14 is the *Circumference* of a *Circle*, whose Diameter is Unity, or 1, for by the Rule of Proportion, as 7 is to 22, so is the Diameter to the Circumference.

Example, the Diameter of a Circle is 23. *What's the Circumference?* Multiply 3.14 by 23, and the Product is the Answer.

3.14
23

942
628

72.22 *The Circumference.*

I shall work the same Question by the Rule of Proportion, as 7 is to 22, so is the Diameter to the Circumference, Divide the Product of the Diameter Multiply'd by 22, by 7, and the Quotient is the Answer.

Example

Example.

7 22 23

66
44

7)506(72.28
16
20
60
4

On the contrary, as 22 is to 7, ſo is the Circumference to the Diameter; ſo Divide the product of 72.28. (Multiply'd by 7) by 22, and the Quotient is the Anſwer.

Example.

22 77 2.28
7

22) 505.96 (22.99
65
219
216
18

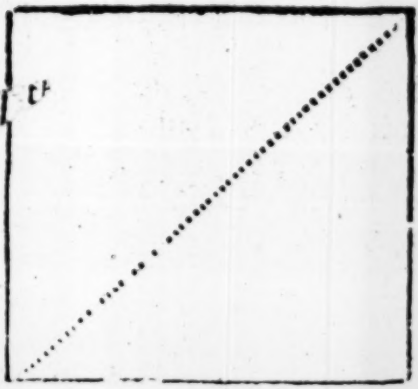
Being

Being 3.14 is the Circumference of the smalleſt Diameter in Inches, it muſt without doubt be a proper Multiplier to find the Circumference of a greater Diameter.

CHAP. II.

Of Gauging Squares, Oblongs, Triangles, Trapeziums, Rhombus and Polygons.

FIrſt, Of a *Square Cooler*, Multiply the ſide by it ſelf, and the Product Divide by 282.



To c

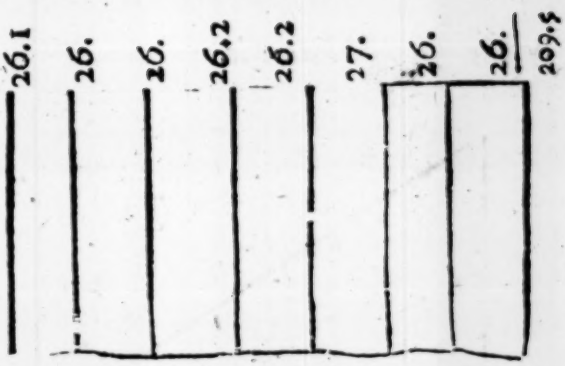
The side 35.4
35.4

1416
1770
1062

1253.16 *The Superficial Inches.*

This Divided by 282, and the Quotient Multiplied by the Depth, produces the Content in *Ale-Gallons*, and Parts of a Gallon.

Secondly, Of an *Oblong*, *Cooler*, or *Back*. You are to find a mean Breadth, and mean Length, if it be irregular or warp'd, by taking the Dimensions in several Places, both in breadth and length, and adding the several Dimensions together, first of the breadth, and then of the length, and Divide the Sum by the Number of Places taken, and the Qotient is the mean, as shall be shewed in the following Example.

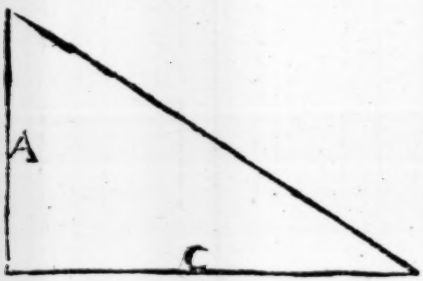


8) 209.5 (26.1
49
15
7

The Quotient here is the mean Breadth; in the same manner you must find the Length, and Divide the Length by the Breadth, and the Product Divided by 282. and the Quotient is the *Area* in *Ale Gallons*; that Multiplied by the Depth, gives you the Content.

Thirdly, To find the Content of *Triangles* of all sorts, there is a general Rule, which is, Multiply half the *Base* by the *Perpendicular*, or half the *Perpendicular* by the *Base*, and the Product is the Content in Superficial Inches, Feet or Yards, *&c.* *Ex-*

Example.



Perpendicular A	20.4
Base C	63.2
Half the Perpendicular	15.2

1264
3160
632

960642 *Superficial Content.*

Divide this Superficial Content in Inches, by the solid Inches in an *Ale Gallon*, *viz.* 282, and the Quotient is the *Area*; or what it holds upon an Inch deep.

Note

* Note, *The Reason you Multiply half the Perpendicular by the Base, or half the Base by the Perpendicular, is, That a Triangle is half a Square or Oblong, whose sides are equal to the Perpendicular and Base.*

There is 6 sorts of Triangles, as follows, *viz.*

An *Equilatrial*, having 3 equal sides and Angles.

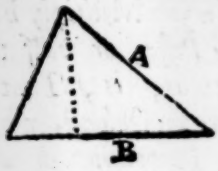
Isosceles, having 2 equal sides and angles.

Scalenos, with all uncqual sides, one being either shorter or longer than another.

Orthogonium, having one right Angle, as *a*, *b*.

Ambligonius, having one blunt Angle.

Oxigo



Oxigonium, having 3 ſharp Angles, and 2 equal ſides, as A, B.

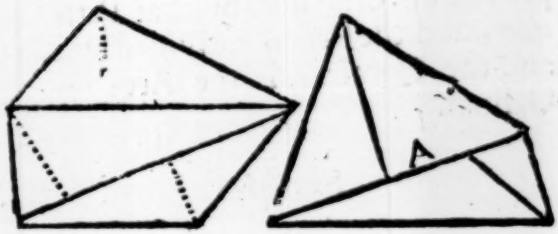
The *Perpendicular* is a Line drawn from one Angle to the nigheſt oppoſite part of the Baſe.

Fourthly, Of Gauging a *Trapezium*, being a Figure of 4 unequal ſides or more, as theſe following Figures. You are to divide it into *Triangles*, by making Baſes, and letting fall *Perpendiculars*: then work as in the foregoing Work of a *Triangle*; and add your ſeveral Contents of the *Triangles* together, and you have the Superficial Content of the whole, the which Divide by 282, and you have the Area.

But the nigheſt way is to Multiply the Sum of the *Baſe* by half the Sum of the *Perpendiculars*.

Example

Example.



The common Base A } 34.2
Half the sum of the Perpendicular. } 17.1

342
2394
342

282) 584.82 (2.07 *Area*

2082
108

When there is a remainder, as here you see, add Cyphers at pleasure, and Divide by the same Divisor, which brings out more *Decimals*.

Fifthly, A *Rhombus*, as the following Figure, you must let fall a *Perpendicular* from one of the *Blunt Angles*,

to the oppoſite ſide, as the prick Line in the following Figure; and Multiply the oppoſite ſide by that *Perpendicular*, and the Product divided by 282, and the Quotient is the Area in Ale Gallons.

Example.

Side——62
Perpendic. 34

248
186

282) 2108 (7.47 *Area*

1340
2120
146

Sixthly,

Sixthly, Of the *Regular Poligons.*

1. *A Pentagon.* 5 *sides.*
2. *An Hexagon.* 6
3. *An Heptagon.* 7
4. *An Octogon.* 8

You must Multiply the *Versed Sine A.* or a Line drawn from the Center to the middle of any one side, by half the Sum of all the sides, and the Product is the Superficial Content; because it is supposed to be so many *Triangles* as there is sides, and therefore you must work as in *Triangles*, or *Trapeziums.*

Example.

Half the Sum of the side 120
Verſed ſine, or Perpend. 13

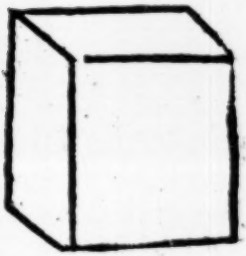
360
120

282) 1560 (5.5 *Area*
1500
90

To find the Center of any *Poligon*, you muſt draw a Line from any one *Angle* to the middle of the oppoſite ſide, and croſs that with another in like manner, and where they Cut each other, there is the Center.

All Regular *Poligons* are Meaſured by the ſame Rule.

Seventhly, A *Cube*, or *Dye* is a Figure of 6 equal Superfices, or ſides, and 24 Angles. The Content is found by Multiplying the ſide by it ſelf, and Multiplying the Product by the ſide, and the laſt Product is the Content, the which divide by 282, and the Quotient is the Ale Gallons contain'd in it.



The Side 28
28

224
56

784
28

6272
1568

282) 21952 (77
2212
238

Example.

Half the Sum of the side 120
Verſed ſine, or Perpend. 13

360
120

282) 1560 (5.5 *Area*
1500
90

To find the Center of any *Poligon*, you muſt draw a Line from any one *Angle* to the middle of the oppoſite ſide, and croſs that with another in like manner, and where they Cut each other, there is the Center.

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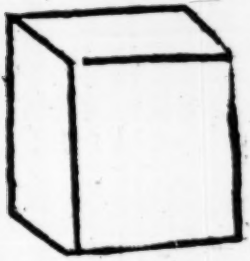


The Side 28
28

224
56

784
28

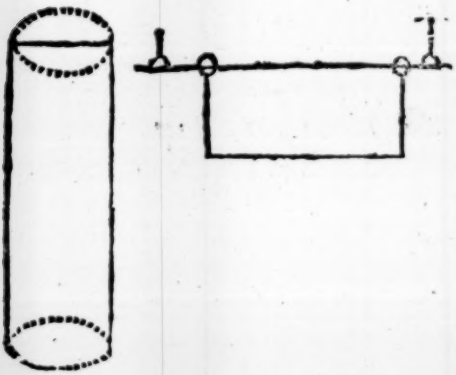
6272
1568

282) 21952 (77
2212
238

CHAP. III.

Of Ciruular, and Eliptical Veſſels ; and firſt of a Cylinder.

A *Cylinder* has equal Diameters in every part, and is in form like the Rowling-ſtone of a Garden ; but may rather be compared to an *Oblong* flying round on an Ax, whoſe ſhorter ſides is equal to the Cemi-diameter of a *Cylinder*, as is demonſtrated in the following Figure.



Square

Square the Diameter, and Divide by 359 for Ale, or by 294 for Wine.

Example.

Cylinders Diameters 32
32

64
96

359) 1024 (2.85
3060
1880
85

Observe to Multiply all Areas by the Inches in Depth, and the Product will be the Content, let the Vessel be of what form it will.

Secondly, I shall describe a *Circle* and the Parts thereof.

A *Circle* is a plain Figure bounded by one Line, regular, without either beginning or end, invironing a *Center*, as A, B, C, D.

The *Diameter* is a right Line Drawn through the *Center*, touching the *Circumference*, as D, B.

A *Chord Line*, is a Line drawn from one part of the *Circumference* to the

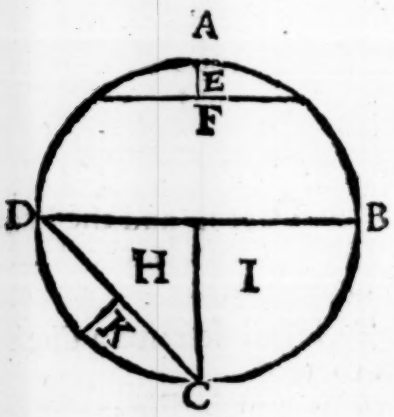
other, leſs than a *Diameter*, as E.

A *Segment* is any portion of a *Circle*, leſs than a *Semi circle*, as A, E, F.

The *Verſed Sine* is a Line drawn from the Center of the *Chord*, touching the oppoſite part of the *Arch*, as E.

The *Radius* is the half, or *Semi-diameter.*

A *Quadrant* is the $\frac{1}{4}$ of a Circle, as I.



It is fit before we proceed any further in *Gauging*, that we underſtand how to find the Superficial Content of a *Circle*, or any Portion thereof, that the Learner may the better underſtand what he is going about; Circular Veſſels being the moſt difficult.

To

To find the Content of a *Circle* in Superficial Inches; Multiply half the Circumference by half the Diameter, and the Product is the Content.

Example.

First find the Circumference by Multiplying the Diameter by the proper Multiplier, *viz.* 3.14

Diam. 20.2
3.14
808
202
606
The Circumference is —— 63.428
Half the Circumference is —31.714
Half the Diameter is —— 10.1
31714
31714
The Superficial Content. — 320.31414

To find the Content of the Quadrant of a Circle, Multiply $\frac{1}{4}$ the Circumference by $\frac{1}{4}$ the Diameter, and the

the Product is the Content of the Quadrant.

To find the Content of the *Segment* K. Multiply the *Verſed ſine* by half the *Arch*, and the Product is the Content.

Example.

Suppoſe the Circum. to be	12.874
The Diameter is	4.100
Half the Diameter is	2.05
Half the Circumference is	6.437

Theſe halfs Multiplyed as before, gives the Content of the *Circle*, *viz.*

13.19585

The Arch or $\frac{1}{4}$ *the Circumf. is*	3.218
$\frac{2}{3}$ *Of the Arch is*	2.1446
The Verſed ſine is	.6
The Content of the Segment	1.28676

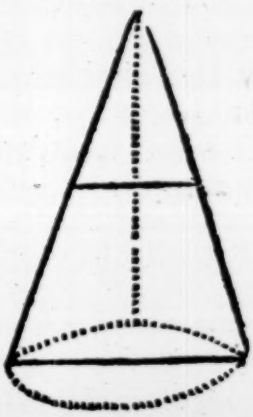
To prove this work, you muſt find the Content of the *Triangle* H, and add to the *Segment*, and it will amount to the Content of the *Quadrant*, the which Multiplied by 4, gives you the Content of the whole Cirlcle.

Ex-

Example.

Perpend. of the Triangle is	1.4
Base	2 9
Half the Perpendicular	.70
The Content of the Triangle	2.03
The Content of the Segment	1.28676
	3.31676
	4
Equal to the Cont. of the Circle.	13.26704

Thirdly, To find the Content of a *Cone*, or *Pyramid*, with a Circular *Base*; it being one Third of a *Cylinder* of the same *Base* and *Altitude*.



You

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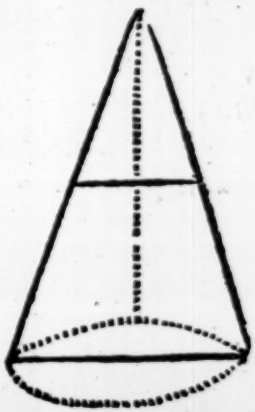
To prove this work, you muſt find the Content of the *Triangle* H, and add to the *Segment*, and it will amount to the Content of the *Quadrant*, the which Multiplied by 4, gives you the Content of the whole Cirlcle.

Ex-

Example.

Perpend. of the Triangle is	1.4
Baſe	29
Half the Perpendicular	.70
The Content of the Triangle	2.03
The Content of the Segment	1.28676
	3.31676
	4
Equal to the Cont. of the Circle.	13.26704

Thirdly, To find the Content of a *Cone*, or *Pyramid*, with a Circular *Baſe*; it being one Third of a *Cylinder* of the ſame *Baſe* and *Altitude*.



You must first find the *Perpendicular* height, which is a streight Line from the *Vertex*, or top, to the Center of the *Base*, as follows.

From the Square of the *slant height*, (that is a line from the *Vertex*, touching the out side of the *Base*) Substract the Square of the *Semi-diameter*, and the difference is the Square of the *Perpendicular*, the *Root* whereof is the *Perpendicular*.

Example.

The Square of the slant height is	420 25
The Square of the Semi-diam. is	43.56
The difference is	376.69
The Root or Perpendicul.	19.4

Multiply the *Area* of the *Base*, by half the *Altitude*, or *Perpendicular*, and the Product is the Content, as in the following Example.

Bases

Bases Diam. is 13.2
13.2

264
396
132

359) 174.24 (.485 *The Area.*
3064 6.46 $\frac{1}{3}$ *The Perp.*
1920
125 2510
1940
2510

2.72910

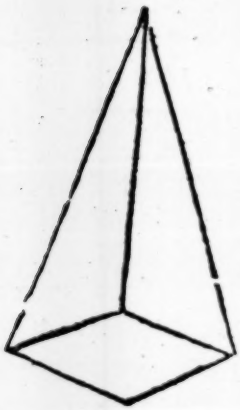
If you divide the Square of the *Diameter* by 1077, and Multiply the Quotient by the *Altitude*, the Product is the Content.

Fourthly, To find the Content of the *Frustum* of a *Cone*.

The half of the Sum of the two *Diameters*, is the *Mean Diameter*, the which Squar'd and Divided by 359 for *Ale Gallons*, or 231 for *Wine*, the Quotient is the Area.

Fifthly,

Fifthly, *To find the Content of a Square Pyramid.*



Square the ſide, and Multiply the Product by the Height, and Divide by 846, and the Quotient is the Content.

The reaſon you Divide by 846, is, becauſe it is Treeple 282, as 1077 is Treeple 359.

Example.

Side —— 46
46
276
418
2116
The height — 106
12696
2116
846) 224296 (265. *Ale-Gallons.*
5509
4336
106

If you Multiply the Square of the *Side* by one third of the *Height*, as in the Round *Pyramid*, and divide by 282 you will have the Content exactly, for 846 is rather too much.

Example

Example.

The Square of the ſide — 2116
One third of the height is 35.3

6348
10580
6348.

282) 74694.8 (261.6
1729
374
1928
236

Sixthly, *To find the Content of the Fruſtum of a Square* Pyramid.

Square the Sum of the two Diameters, then Multiply the greater by the leſſer, Subſtract the leſſer Product from the greater, and the remainder Divide by 846, and the Quotient is the Area.

Or if you find a mean between the two ſides, *viz.* the ſide at *Top*, and the ſide at *Baſe*, and Square it, and Divide by 282, you have the *Area*; the which Multiplyed by the depth, gives you the Content.

Seventhly,

Seventhly, *To find the Content of an* Elipſis, *or* Qvål.

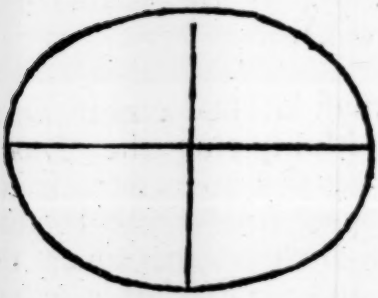
You muſt firſt find a mean Diameter, by Multiplying the *Tranſverſe* and *Conjugate* Diameters by each other, and the *Square-Root* of the Product is the *Mean Diameter*, the which being *Squared*, and the Product divided by 359, gives the *Area*.

Example.

Length–24.1
Breadth. 23.1

241
723
482

556.71 (23.5 *The mean Diam.*
156
129
2771
2325
446



If the Veſſel be wider at top than bottom, you muſt find a mean Length between the bottom Length and top Length, by adding them together, and taking half the Sum, in like manner the Breadths, and work as before.

If a Veſſel be *Eliptical* above, and *Circular* below, which ſometimes happens by putting hot Worts into a New Veſſel; you muſt Multiply the one into the other, as before, and extract the *Root* for the *Mean*; the which add to the *Diameter* of the *Circular Baſe*, and half the Sum is the *Mean Diameter* of the Veſſel.

There is another way of finding the *Mean Diameter* of an *Elipſis*, by adding the *Diameters* together, and taking the half for the *Mean*; or if the Tub be wider at top than bottom, add the 4 *Diameters* together, and take the $\frac{1}{4}$ for the

the *Mean*, as in this following *Example*.

Top Length —— 46.2
Top Breadth —— 37 4
Bottom Length — 43.1
Bottom Breath — 34.2

4) 160.9 (40.2
1

To find the Content of a Copper.

You are to take *dimensions* in 3 several Parts, *viz.* As nigh the bottom as you can, for the *Crown*, and then in the middle: Thirdly, within 4 Inches of the Top; for if you take it at the Top, you do wrong; for it is impossible to boyl a *Copper* full of Worts; moreover one Inch of the Top, contains more than two in the Bottom. Now you are to add these 3 Dimensions together, and the one third of them is the *Mean* Diameter, the which *divide* by 359, and the *Quotient* is the *Area*.

For the *Rising Crown* of a Copper, you are to Multiply the *Area* of the *Base* by half the *Altitude*, and the Product is the Content.

Example.

Example.

The Diameter at Baſe is	71.50
The Area is	14.24
The Height 31 2,½ *of it is*	15 6
	8544
	7120
	1425
The Content is	222.244

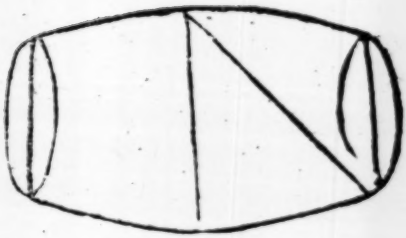
CHAP. IV.

Of Cask Gauging.

I Shall now proceed to *Cask-Gauging*, particularly the *middle Fruſtum* of a *Spheroid*; it being the moſt uſual Form. I might Treat of a *Conoid* and *Parabolick*, but by reaſon they ſeldom or never fall in ones way, I ſhall omit them for brevity's ſake.

Example.

Example.



Bong Diameter —— 36.3
Head Diameter —— 31.5
Length —— —— 42.0

I ſhall ſuppoſe the *Bong Diamiter* of a *Spheroid* to be 36.3, the *Head* to be 31.5. I deſire to know the *Content* of the *Cask*, its Length being 42.

You muſt find a *Mean Diameter* by Subſtracting the *Head* from the *Bong*, and Multiplying the difference by .7, and adding the Product to the leſſer Diameter, and the Sum is the *Mean Diameter*, the Square whereof Divided by 359, Exhibits the *Area*, the which Multiply by the *Depth*, and you have the *Content* in *Ale-Gallons*, or by 231 for *Wine-Gallons*.

Example.

III. *Example.*

Length	42
Bong	36.3
Head	31.5
	48
	.7
	336
	3150
	3485 *The Mean Diameter.*
	1215.2196 *The Square of the Diam.*

359) 1215.2196 (3.3850
1382 42
.3051
.1799 67700
45 135400

The Content is 142.1700

Another way, which is a Proof to the former is, to twice the *Square* of the *Bong*, add the *Square of the Head*; the Sum Multiply'd by the *Length*, and the Pro-

Product Divided by 1077, gives you the *Content* in *Ale-Gallons*.

Example.

The double Sq. of a Bong	2635.38
The Square of the head	992.25
The Sum	3627.63
The Casks Length	42
	725526
	1451052

1077) 152.360.46 (141.37
4466
1480
4034
8036
497

What is the Reason you add twice the Square of the *Bong Diameter*, to once the square of the *Head*?

Ans. Because the Boulging of the Cask towards the *Bong* is more *Arching* than at the *Head*; for it does not *Rise* or *Arch* gradually. If you take the Diameter at the *Bong*, and the Diameter

6 Inches from the *Bong*; and the Head Diameter, you shall find the difference of Diameters between *Head* and *Bong*, to be twice as much as that between the *Bong*, and 6 Inches from it.

To find the content of the Fruſtum of a Spheroidal Cask.

The moſt common way is, to add the *Diameters* of the *Cut-end*, and *Uncut-end* together, and Subſtract the half Sum from the *Bong Diameter*, and Multiply the difference by 7, and the Product add to the leſſer Diameter, and that is the *Mean Diameter*, the Square whereof divided by 359. Quotes the *Area* in *Ale Gallons*, or by 294 for *Wine*. But the moſt exact way is to find a *mean Diameter* between the *Cut-end* and the *Bong*, and the *Uncut-end* and the *Bong*, as in the following Work.

Example.

Example.

The Casks whole Length is			54
Inches. 4 *Inches cut off, remains*			50
Bong Diam.	30	*Bung Diam.*	30
Uncut end	23	*Cut end*	26
The Difference is	7		4
	·7		·7
	4·9		2.8
	23		26
The mean Diam.	27·9	*The Mean*	28.8

The cut ends Area is 231
The uncut ends Area is 2.16

Multiply these two *Area*'s severally by the *Length*'s, *viz.* The length of the *cut End* from the *Bong* 23, and the *uncut End* 27, and the Product is the Content.

To find the Ullage of a Cask, with its Axe Parallel, to the Horizon; being the middle Frustum of a Spheroid.

We shall suppose the *Content* of a *Cask* to be 63 *Gallons*, the *Bong Diameter*

to be 25.4, the *Wet Inches* 16.2, the dray 9.2. I desire to know the *Ullage* thereof, without the *Table of Segments.*

The *Rule* is, divide the *Wet*, or *Dry Inches* by the *Bong Diameter*, and if the Quotient exceed .50, Subduct .50 from it, and divide the difference by .4, then add that Quotient to the former, and Multiply the Sum by the Content, and the Product is the Answer.

If it happen that your Quotient do not exceed .50, you must Subduct it from .50, and work as before-said. Only subduct the greater Quotient from the lesser. Observe to Post-pone *Cyphers* to the *Dividend.*

Exampl

Example.

The Casks Content —— 63 *Gall.*
The Bung Diameter —— 25.4 } *Inches*
The wet Inches —— 16.2 }
The dry —— 9.2 }

25.4) 16.200000 (.63779
960
1980
2020
2420
134

.63779
.50000

4) .13779 (.03444

.03444
.63779

The Sum. .67223
The Content. 63

201669
403338

42.35049 *Remaining Liquor*

The *Proof* is, by dividing the dry Inches, as you have done the wet; and

if the *Ullage* and *Remaining Liquor* make the *Content*, it is right.

```
25·4) 9.2000 (·36220
      1580
       560
       520
        120

 ·50000
 ·36220
 ------
4) ·13780 (·03445·
 ------
 ·36220
 ·03445
 ------
 ·32775
    63
 ------
  98325
 196650
 ------
20 64825 The Ullage.
41·35049 The Remaining Liquor.
--------
62·99874 The Sum.
```

To

To find the Ullage by the Table of Segments.

Admit the *Content* of the *Cask* and the Dimensions be as in the foregoing Question.

Divide the *wet* or *dry Inches* by the *Bong Diameter*, and the *Quotient* seek for in the *Table of Segments*, under V. and over-against it you will find a *Number*, the which you must Multiply by the *Content*, and the Product is the *Vacuity* if you divided the *dry Inches*; and if the *wet*, the *remaining Liquor* in the *Cask*

Observe always in your dividing by the *Bong Diameter*, that if the *remainder* be above half the *divisor*, you must add one more to the last Figure in the *Quotient*.

Example.

The Content ——————— 63 *Gallons*
The Bong Diameter ——— 25.4
The dry Inches ——————— 16.2

25.4) 16.200 (.64
960
198

The Segments *Area by the Table* .6759
The Content ——— ——— 63

20277
40554

The Remaining Liquor ——— 42.5817

Here you see it is the same with the former, therefore it needs no pro of.

Circles Area's of Segments.

V.	Area	V.	Area	V.	Area	V.	Area
1	.0017	28	.2292	55	.5635	80	.8576
2	.0048	29	.2407	56	.5762	81	.8677
3	.0087	30	.2523	57	.5888	82	.8776
4	.0134	31	.2644	58	.6014	83	.8873
5	.0187	32	.2759	59	.6140	84	.8967
6	.0245	33	.2878	60	.6265	85	.9059
7	.0308	34	.2993	61	.6389	86	.9149
8	.0375	35	.3119	62	.6513	87	.9236
9	.0446	36	.3241	63	.6636	88	.9320
10	.0520	37	.3364	64	.6759	89	.9402
11	.0598	38	.3487	65	.6881	90	.9480
12	.0680	39	.3611	66	.7002	91	.9554
13	.0764	40	.3735	67	.7122	92	.9625
14	.0851	41	.3860	68	.7241	93	.9692
15	.0941	42	.3986	69	.7360	94	.9755
16	.1033	43	.4112	70	.7477	95	.9813
17	.1127	44	.4238	71	.7593	96	.9866
18	.1224	45	.4364	72	.7708	97	.9913
19	.1323	46	.4491	73	.7822	98	.9952
20	.1424	47	.4618	74	.7934	99	.9983
21	.1527	48	.4745	75	.8045		
22	.1631	49	.4873	76	.8155		
23	.1737	50	.5000	77	.8263		
24	.1845	51	.5127	78	.8369		
25	.1955	52	.5255	79	.8473		
26	.2066	53	.5382				
27	.2178	54	.5509				

	Dim.		Area		
0	36	.0	0.00		
1	35	.7	3.55		*The content of the first 6 Inches.*
2	35	.4	3.49	17.14	
3	35	.1	3.42		
4	34	.8	3.37		
5	34	.5	3.31		
6	34	.2	3.26		
7	33	.9	3.20		
8	33	.6	3.14	18.71	
9	33	.3	3.09		
10	33	.0	3.03		
11	32	.7	2.99		
12	32	.4	2.92		
13	32	.1	2.87		
14	31	.8	2.82	15.84	
15	31	.5	2.76		
16	31	.2	2.71		
17	30	.9	2.66		
18	30	.6	2.61		
19	30	.3	2.55		
20	30	.0	2.51		
21	29	.7	2.45	14.88	
22	29	.4	2.41		
23	29	.1	2.35		
24	28	.8	2.31		
25	28	.5	2.26		
26	28	.2	2.21	13.14	
27	27	.9	2.17		
28	27	.6	2.12		
29	27	.3	2.07	79.71	*The Content.*
30	27	.0	0.00		

If

If the *Tun* be the *Fruſtum* of a *Cone*, and ſtand upon its leſſer *Baſe*, you are to find an *Addend*, the which you muſt add to the *Diameter* an Inch from the *Bottom*, and ſo Gradatim to every Inch, till you come within an Inch of the *Top*; this done, you muſt find *Area's* to each of theſe *Diameters*, and the *Sum* of the *Area's* is the *Content* of the *Tun*.

The way to find the *Addend* is by Subducting the *Bottom* from the *Top Diameter*, and dividing the *difference* by the *depth*, and the *Quotient* is the *Addend*; but if the remainder in your Diviſion be above half the Diviſor, you are to make your *Addend* one more every third time.

Example.

Top Diameter ——— 36
Bottom ——— 27

Deep 30) 90 (.3 *The Addend*

There is many other ways of *Inching a Tun*, but there is none comes nigher the truth than this, therefore I would not adviſe any to uſe any other

Cramp way, this being both eaſy and honeſt.

Note, *That if the* Tun *ſtand on its* Greater Baſe, *you are to find a* Subducend *by Subducting the* Top *from the* Bottom, *and dividing the* difference *by the* Depth *as before, and the Quotient is the Subducend, the which muſt be Subducted from, as the other was added to.*

Some neceſſary Rules very uſeful in Gauging.

Divide 282 by the *Area* of *Unity*, *viz.* .7854, and the Quotient is 359, the Square-Root whereof is the *Gauge Point*, 18.95. or Multiply 282 by 1.2735, *viz.* the Square of the Diameter of a Circle, whoſe *Area* is 1 000, or Unity with Cyphers, and the Product is the ſame.

Divide 1.000. by 3.14, and the Quotient is .318, a Multiplier to Multiply the Circumference by to find the Diameter.

Divide 1.000 by .318, and the Quotient is 3.14, a Multiplier to Multiply the Diameter by to find the Circumference.

The Area of a Circle is 1.47, *what's the Diameter.*

Answ. Multiply the *Area* by 359, and the *Square-Root* of the Product is the Diameter; the Multiplying the *Area* by 359, brings out the Square of the Diameter, the *Root* whereof must consequently be the Diameter.

Having the Circumference to find the Area in Inches.

Square the Circumference, and Multiply the Product by .079578, and the last Product is the *Area*, .079578 is the *Square* Root of the Circumference of a Circle, whose *Area* is 1.000 or Unity.

Having the Area of a Circle to find the Circumference.

Multiply the *Area* by 12.5664. *viz.* The Square of the Circumference of a Circle whose *Area* is Unity.

If you would reduce Ale Gallons into Wine Gallons, you must Multiply the Number of Ale Gallons by 1.22, being the Quotient of 281, divided by 231, and the Product is the Answer.

On the contrary Multiply the Wine Gallons by 81.91, the Quotient of 231 divided by 282, and the Product is the Answer.

A general Rule to find Multipliers that will perform the same Operation that Divisors does, and the Contrary.

Divide Unity, or 1.0000 by the Divisor, and the Quotient is a Multiplier; or Divide 1.0000 by the Multiplier, and the Quotient is a Divisor.

Example.

35) 1.0000 (.0284
300
200
60

.0284) 1.0000 (35
1480
60

If a Tub at 12 Inches deep hold 163 Gallons, what's the Diameter?

Multiply 163 by 359, and divide the Product by 12, the Inches deep, and the *Square Root* of the Quotient is the Diameter sought. If

If the Gauge Point give one Gallon on an Inch, what Diameter will give a Gallon on 5 Tenths of an Inch in depth.

Answ. You must Multiply 359, the Square of the *Gauge Point*, by 1.0, and the Product divide by .5 and the *Square* Root of the Quotient is the Diameter of a *Circle* that will hold one Gallon upon .5 of an Inch deep.

Example.

359 : 1.0 : .5

.5) 359.0 (718
40

Extract the Root of this — 718 (26.7
318
4200
511

The Quotient 26.7 is the Diameter, which gives one Gallon on .5 tenths of an Inch.

Having

Having two Numbers given to find a Mean Proportion between them.

Multiply the two Numbers, the one into the other, and the *Square Root* of the Product is the Anſwer.

Example.

Suppoſe the two Diameters be 81.7, and 41.3, the Product of theſe two Numbers is 3374.21, the *Root* whereof is 58.8, which is the mean Proportion between theſe two Numbers, the Square whereof is equal to the Product of the Extreams.

Having the Content of any given Superfice, to find the Side of a Square equal to the given Superfice.

Extract the *Square Root* of the Content, and the *Root* will be the ſide of a Square equal to the Superfice given.

Example.

Example.

The *Base* and *Perpendicular* of a right Angled *Triangle* is 16 and 18, the Content whereof, according to the Rule in the second Chapter, is 144, The *Root* whereof is 12, the side of a *Square* equal to the said *Triangle.*

Having any two sides of a right Angled Triangle *to find the third.*

According to *Euclid's* 47 Proposition, the Square of the *Hypothenuse*, or Slant Side of a Right Angled *Triangle* is equal to the Sum of the Squares of the *Base* and *Perpendicular.*

Example.

Suppose the *Base* and *Perpendicular* of a *Triangle* to be 48 and 36, the Square of 48^2 is 2304, and the Square of 36 is 1296, the Sum of both is 3600, which is equal to the Square of the *Hypothenuse*, the *Root* whereof is the *Hypothenuse.*

Having the Content of a Cask, the Bung and Head Diameters to find the Length.

Multiply the Content by 1077, and the Product divide by the Sum of the double Square of the Bung Diameter, and the Quotient is the Length.

Example.

The Sum of Bung and Head ——	1836
The Content —— —— ——	61.37
—— —— —— —— ——	1077
The Product —— —— ——	66095.49
The Quotient of this Product divided by 1836. ——	35.95

35.95 *Is the Length Required.*

Having the Content, Length and Head Diameter to find the Bung Diam.

Multiply the Content by 1077, and divide the Product by the Length, Doubled, and from the Quotient Subduct half the Square the Head Diameter, and the Square Root of the re-

remainder is the Bung Diameter ſought.

Having the Length of a Cask, and the Bung Diameter to find the Diagonal.

To the Square of the Semi-length, add the Square of the Bung Diameter, and the Square Root of the Sum is the Diagonal ſought.

Example.

The Semi-Length is	26.20
The Square of it is	686.44
The Square of the Bung	1156.00
The Sum is	1842.44
The Square Root or the Diagonal is	42.90

By the foregoing Rules you may underſtand how to *Gauge* Large Veſſels; but if in any Caſe it ſhould be required how to *Gauge* a Tankard, Pot or ſuch like ſmall Meaſure, I believe it would a little puzle the *young Gauger*, but I ſhall here give him directions how he may do it; and how to find his ſeveral *Gauge Points* and the Squares thereof for the ſame uſe. Firſt,

First, *You are to understand that in an Ale Gallon there is Cub. Inches*	282
In a Pottle	141
In a Quart	70.5
In a Point	35.25
In a Wine Gallon there is	231
In a Pottle	115.5
In a Quart	57.25
In a Pint	2864

In the next place you are to find the *Gauge Point* for the quantity you are to work by.

1st. I desire to have a *Gauge Point* for Pints in Ale Measure.

In the foregoing Table the Pint of Ale Contains 35.25 Cubical Inches; this I divide by the Area of Unity, *viz.* .7853, and the Quotient is the Square of the *Gauge Point*; the Root whereof is the *Gauge Point*.;

Example.

Example.

```
.7853) 35.25000 (44.88
        5838
       69680
        68560
         5736
```

This Quotient, *viz.* 44.88 is the Square of the *Gauge Point* for Ale Pints; by the which, if you divide the Square of any Diameter the Quotient is what it holds upon one Inch deep in Pints or Parts of a Pint.

To prove this to be the true Square of the *Gauge Point* for Pints of Ale; I Multiply it by 8. being the Pints in a Gallon, and the Product is the Square of the *Gauge Point* for Gallons.

Example.

Example.

The Square of the Gauge Point is 44.88
The Pints in a Gallon is ——— 8

The Square of the Gauge Point for Gallons ——— } 359.04

There is a Pot or Tankard whose Mean Diameter is 3.50, what's the Content, its Length or Depth being 4 Inches.

Answer.

The Diameter is ——— 3.5
3.5
175
105
44.8) 12.25 (.27
3270 *deep.* 4
144
This is the Content. ——— 1.08

Which is one Pint, and $\frac{8}{100}$ of a Pint, which is but a small quantity.

If you be to *Gauge* any thing which hold less than a Pint, you must divide by half the former divisor, *viz.* 22.4, or one fourth of it, *viz.* 11.2. and the Quotient is the half Pints or Quarter Pints contained therein.

CHAP.

CHAP. V.

Mensuration of Plain Superfices, Such as Board, Glass, Wainscoat, Painting, or Paving, &c.

IN *Superficial Measure* the Square of 12 Inches is a Foot, being 144 Inches.

Note, *That the Squaring of a Number is Multiplying it in it self.*

If you would know how many Foot Square is in a Yard Square, you must Multiply the Feet in a Yard, *viz.* 3 by it self, and the Product is 9, the Square Feet in a Yard.

Example.

Example.

How many Inches Square is there in a Yard Square.

12
3

36
36

216
108

1296 *Square Inches.*

The General Rule is to Multiply the Length by the Breadth (let it be Inches, Feet, or Yards) and the Product is the Content.

1. I ſhall ſuppoſe a Plank to be 20 Inches Long, and 16 Inches Broad. I demand how many Superficial Feet is in it? Multiply the one by the other, and Divide by 144.

Length

Length 20
Breadth 16

120
20

144) 320 (2.22 *Feet*
320
320
32

I shall work the same Question by the *Rule of Practice*, for a Proof of the other.

Perhaps the Learner may be a stranger to this Rule; therefore I shall explain it as far as room will permit.

First, you are to Multiply the Length by the Breadth, being stated in Feet and Inches, saying, once 8 is 8, and once 1 is 1, then take the one third of 1 foot 8 inches, which is 6 Inches and an half, being added together as follows, the Product is two Foot two Inches and an half, the Content of the Plank. The reason you take the one third is, because 4 Inches is the one third of a Foot.

	Foot		*Inches*
Length	1	:	8
Breadth	1	:	4
	1	:	8
			$6\frac{1}{2}$
	2	:	$2\frac{1}{2}$ *Equal.*

Secondly, There is 3 Planks, one 3 Foot long, and 2 Foot broad; another 2 Foot and an half long, and 2 Foot and a quarter Broad; the third is 4 Foot and a quarter long, and 3 Foot 3 quarters broad, how many Square Feet is there in all these Boards or Planks.

Note, *That the Decimal for one fourth of a Foot is* .25, *for one half* .50, *and for three quarters* '75.

Length

Length	2	2.50	5.25
Breadth	3	2.25	3.75
Foot	6	1250	2125
		500	2975
		500	1275
		5.6250	15.9375
			5.6250
			6
Number of Feet			27.5625

By the Rule of Practice.

Long	2 : 6	4 : 3	3
Broad	2 : 3	3 : 9	2
	5 : 0	12 : 9	6
	7½	3 : 2¼	
	05 : 7½	15 : 11¼	(6
	15 : 11¼		
	06 : 00		
	27 : 6¾	*Equal to the former*	

Thirdly, There is a Plank 10 Inches broad at one end, and 7 at the other, and 64.5 in length, how many Square Foot is in it. Add both ends together, and take half the Sum for the mean breadth.

10
7
17
8.5 *The half*

Length 64.5
Breadth—8.5

3225
5160

144) 548.25 (3.807
1162
1050
42

Fourthly,

Fourthly, *There is a Piece of Painting* 16 Foot *and an half in Length, and* 12 *and a quarter* Broad, *how many Foot is therein.*

Feet	*Inches*	*Decimal*
16.	6	16 50
12.	3	12.25
32	0	82.50
165	0	3300
4	1½	3300
		1650
202	1½	202.1250

In the foregoing Queſtion, in *Practice* it is harder then if the Number of Feet were under 10. For you muſt firſt Multiply the Number of Feet by it ſelf, then ſay 12 times 6 Inches is 6 Foot, which being added to it, makes 18 Foot; then the quarter of 16 Foot and an half is 4 Foot 1 Inch and an half, which amounts to in all 202 Foot and one Inch and an half. To bring it into Yards, divide by 9. for there is 9 Foot in a Superficial Yard,

as you may see in the following Example.

Example.

9) 2021250 (22.4583
22 ..
41
52
75
30
3

In 202 Foot one inch and an half, there is 22 yards and above a quarter of a yard.

There is a piece of Pavement 6 yards and an half long, and five yards and a Quarter broad, how many Square yards is therein.

By Decimal	*By Practice*
6.50	6 :
5.25	5 : $\frac{2}{4}$
3250	32 : $\frac{1}{2}$
1300	1 : $\frac{1}{8}$
3250	
34.1250	34 : $0\frac{1}{8}$

* Note, *In the Practice way, you must Multiply the half yards by* 5, *which is two yards an an half; then* 5 *times* 6 *yards is* 30, *and two and an half, is Thirty two and an half; and the quarter of six yards and an half is* $1\frac{11}{2}$. in all it is 34 yards, and the eighth part of a yard.

If a Board be 5 *Inches Broad, and* 19 *long, what is it over or under a Square Foot.* Multiply the Length by the Breadth, and the Product Subduct from 144, and the difference or remainder is what it wants. If your Product had been above 144. then you was to Sub. 144 from it, and the remainder was what it was above.

Example.

19
5

144 95
95

Wants 59 *Inches*

If a Plank be 9 *Inches broad, I desire to know what length will make a Square Foot.* Divide 144 by 9, and the Quotient is the Answer.

9) 144 (18
54
00

If a Board be in Breadth 18 Inches, what length will be a Square Foot.

18) 144 (8
000

There

There is a Pane of Glass 4 Foot long, and 2 Foot and an half Broad, *How many Superficial Feet is therein?*

Answer.

Length	4 : 0
Broad	2 : 5
	20 0
	80
	10.0 0 *The Content in* Feet.

The same Question by the Rule of *Practice.*

Example.

	Feet	*Inches*
Long	4 :	0
Broad	2 :	6
	8 :	0
	2 :	0
	10 :	

There

There is 3 Panes of Glaſs, one is in Length 6 Foot and an half, and in Breadth 2 Foot and a quarter, another 4 Foot Long and 3 Foot Broad, the third is 8 and a quarter Long, and 6 Broad. I demand how many Feet in all.

Anſwer.

	Feet		*Inches*				
Length ——	6	:	6	:	4	: 8	: 3
Breadth ——	2	:	3	:	3	: 6	: 0
	13	:	0	12 =	49	: 6	
	1	:	$7\frac{1}{2}$				

	Feet		*Inches*
The 1ſt Pane	14	:	$7\frac{1}{2}$
The Second	12	:	0
The Third	49	:	6
	76	:	1, *The Content of all.*

CHAP.

CHAP. VI.

Menſuration of Solid Wood or Stone.

THere is a Piece of Timber 63 Inches Long, 32 Broad, and 15 thick, how many Solid Feet is therein.

You are to Multiply the Length by the Breadth, and the Product by the Thickneſs, and the laſt Product Divide by the Inches in a Solid Foot, *viz.* 1728, which is the Cube of 12, for 12 Multiplied in it ſelf is 144, and that by 12, is 1728.

Example.

			Foot		Inches
Length	63	*Long*	5	:	3
Broad	32	*Broad*	2	:	8
	126		10	:	6
	189		3	:	6
	2016		14	:	0
Thick	15	*Thick*	1	:	3
	10080		14	:	0
	2016		3	:	6
1728)	30240 (17.5		17	:	6
	12960				
	8640				
	0000				

There

There is a piece of Timber 18 *inches long, and* 15 *round, and* 6 *inches thick at one end, and* 4 *at the other, how many Solid Feet is therein?* You must find a mean thickness by taking the half of the Sum of the ends and work as before.

Example.

		Foot	*Inches*
Length	18	1	6
Breadth	15	1	3
	90	1	3
	18		$4\frac{1}{2}$
	270	1	$10\frac{1}{2}$
Mean thick	5		5

1728) 1350.00 (.78 *The* $\frac{1}{2}$ *is* $7\frac{1}{2}$
The $1\frac{1}{2}$ *is* $1\frac{1}{8}$

15040
1216

0 : 9. $\frac{1}{8}$

The foregoing Question is very hard in the Rule of Practice, being the whole Solidity is under a Foot, for after you have Multiply'd the Length by the Breadth, you are to find the one third and the one sixth of the Product, which is the Solid Content or three fourths of a Foot, and one eighth of an Inch.

There

There is a Stone 3 Foot 6 *Inches long, and* 2 Foot 3 *Inches Broad, and* 2 Foot *Thick, what's the Content.*

Length ——	3	:	6
Breadth ——	2	:	3
	7	:	0
			$10\frac{1}{2}$
	7	:	$10\frac{1}{2}$
Thick —	2	:	00
	15	:	09

Of the Regular Poligons.

There is a Stone in the form of an *Octogon*, having 8 equal Sides, each side being 6 Inches broad. I demand the Content in *Solid Feet*, it being 16 Inches long, you muſt Multiply a Line drawn from the Center, to the Middle of any Side, by half the Sum of the Sides; then Multiply that Product by the Length, and you have the Content in Inches, the which divide by 1728, gives you the Content in Feet.

The Sides — 8	1392
The Inches — 6	16
48	8352
	1392
Half the Sum 24	
The Line — 5.8	2227.2 *Solid Inches.*
192	
120	
1392 *The Superficial Inches.*	

1728) 2227.2 (1.28
4992
15360
1536

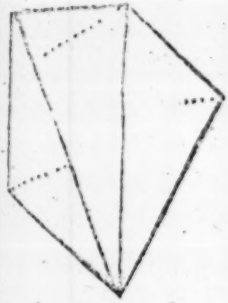
Here I find the Solid Content to be 1 Foot, and above one fourth of a Foot.

The ſame Rule is uſed in all the *Regular Poligons*, as is uſed in the foregoing.

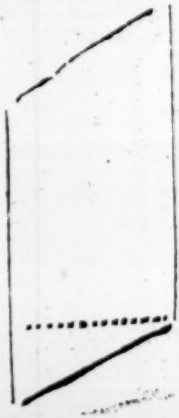
Of

Of Triangles, Trapeziums, and Rhomboides.

A *Triangular Stone* whose *Base* is 3 Foot 6 Inches, and *Perpendicular* 2 Foot 8 Inches, what's the Content; you must Multiply the whole *Base* by half the *Perpendicular*; and the Product is the Superficial Content.



A *Trapezium.* You are to Multiply the common Base by half the Sum of the Perpendiculars.



A *Rhombus.* Multiply the longest side by a Perpendicular let fall from the blunt Angle to the opposite side, and the Product is the Content in Inches or Feet.

The

The Superficial Content of these being found as before directed, you are to Multiply it by the Depth, Thickness, or Length, and you have the Solid Content either in Inches or Feet.

The Triangle.

	Foot	*Inches*
Base	3	6
Half the Perpen.	1	4
	3	6
	1	2
	4	8 *Superficial Content.*

You are to Multiply this by the Length, and you have the Content in Solid Feet and Inches.

The Trapezium.

The Base	4	3
Half the Sum of the Perp.	2	0
	8	6 *Superficial Content*

The Rhombus.

Side —— 6 - 4
Perpend. 3 - 3

19 -- 0
1 - 7

20 - 7 *Superficial Content.*
Length —.8 - 7

164 - 6
10 - $3\frac{1}{2}$

174 -- $9\frac{1}{2}$ *Solid Content*

Of Pyramids.

A *Square Pyramid.* You must Multiply the *Area* of the *Base*, by one third of the height, and the Quotient is the Solid Content.

Example

Example.

The Baſes ſide is	3 - 4
	3 - 4
	10 - 0
	1 - 1¼
	11 - 1¼
One third of the height	4 - 0
	44 - 5 *The Solid Content*

Of Round and Triangular *Pyramids* you are to uſe the ſame Rule.

A Globe or Sphere.

A *Globe* is two thirds of a *Cylinder*, whose Diameter and Altitude are equal to the Diameter of the *Globe*.

There is a *Globe* whose Diameter is 61.7. I demand the Content in solid Feet.

Note, That two-thirds the *Area* of *Unity* is .523598, which is the Content of a *Sphere*, whose Diameter is Unity; the which Divided by 1728. Quotes .0003041 : If the *Cube* of the Diameter of any *Globe* be Multiply'd by this, the Product is the Content in Square Feet.

A Globes Diameter —— 61.7
The Square is —— 3806.89
The Cube is —— 234885.093
.0003041

234885093
939540372
704655279

70 5615567813

The Content of the Globe is 70 Foot and above an half. *There*

There is a Solid of 20 *Equilatrial Sides and Angles, each Side of the Triangles being* 30 *Inches. I demand what's the Content in Solid Feet.*

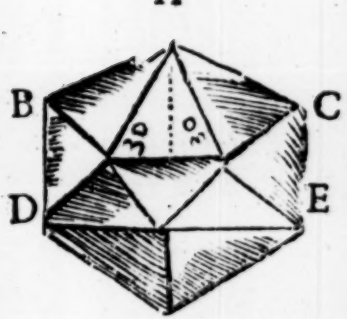
Answer, The Part A, B, C, muſt be taken for a *Pentagonal Pyramid*, and the Content found thus.

You are to Multiply the half of the Sides, each ſide being 30, by the Perpendicular, being 27, and that gives you the Superficial Area. Multiply that by one third of the Perpendicular height, and you have the Solid Content in Inches of the part A, B, C, the which Multiply by 2, and Divide by 1728, and you have the Content of the two *Pyramidal Parts* in Square Feet.

Now to find the Content of the middle Part, being a *Pentagon*. You are to Multiply the *Area* of the Baſe by the Perpendicular of the one of the *Triangles*, and you have the Content in Inches thereof, the which added to the Content of the Perpendicular, gives you the Content of the whole Solid.

Example.

Example.



The Sum of the Sides is	150
The half of the Sum is	75
The Perpendicular is	27
	525
	150
The Area in Inches	2025
One third of the perpendicular height	6
The Content in Inches	12.150
The Double whereof is	24300

1728) 24300 (14
7020
1080

The Content of the two Pyramidals is 14 Foot, and a little more which is of ſmall value.

In the next place I ſhall find the Content of the middle Part D, E,

The Area in Inches is —— —— 2025
The Perpendicular is —— —— 27

4175
4050

The Content in Inches —— —— 44675

1728) 44675 (25.8
10115
14750
929

The Content of the middle part F, G, is 25. Foot, and above three fourths of a Foot.
The Content of the two Pyramidals is 14. 00
The Content of the middle part 25. 80

The Sum of the whole Solid Figure is 39.80

A Table shewing the true quantity of one Foot Length of any true Squared piece of Timber, for Inches, and half Inches.

Inches Square.	F.	pa.		F.	pa.		F.	pa.
		0.002		1.085			4.166	
1	0	007	13	1.174	25	4	340	
		0.016		1.266			4.513	
2	0	028	14	1.361	26	4	694	
		0.043		1.460			4.877	
3	0	062	15	1.562	27	5	063	
		0.085		1.668			5.250	
4	0	111	16	1.778	28	5	445	
		0.140		1.891			5.670	
5	0	174	17	2.007	29	5	840	
		0.210		2.127			6.043	
6	0	250	18	2.250	30	6	250	
		0.293		2.377			6.460	
7	0	340	19	2.507	31	6	673	
		0.390		2.641			6.890	
8	0	444	20	2.778	32	7	111	
		0.502		2.918			7.333	
9	0	562	21	3.062	33	7	562	
		0.57		3.210			7.780	
10	0	640	22	3.301	34	8	028	
		0.765		3.516			8.263	
11	0	840	23	3.673	35	5	507	
		0.919		3.835			8.750	
12	1	000	24	4.000	36	9	000	

The

The Use of the TABLE.

HAving the true Square of any piece of Square Timber in Inches, and the Length thereof in Feet, to know the Content thereof in Feet. Take the Number answering to the Square of Inches out of the Table, and, Multiply it by the Length in Feet: thus, a piece of Timber 18. Inches Square, and 25 Foot Long. The Number answering to 18. *Inches Square is* —— 2250

Which Multiplied by —— 25

The Product is —— 56.250

Viz. 56 *Foot and one quarter*

CHAP.

CHAP. VII.

Of Round Timber.

THE common way used by *Carpenters* for Measuring *Round Timber* is, to Girdle the Tree in the middle, and Multiply that *Circumference* by it self, and the Product Multiply by 7. and that Product Divide by 88. and Multiply that Quotient by the Length, and the Product Divide by the Square Inches in a Foot, *viz.* 1728. and the last Quotient is the Square Feet contain'd in that *Tree* or piece of *Timber.*

Example.

There is a Tree 72 *Inches circumference, and in Length* 94 *Inches, How many Square Feet is therein.*

72
72
144
504
5184
7
88) 36288
108
208
320
56
1728) 38756.2 (22.4 Foot
4196
7502
490

412.3
94
16492
37107

There is another way used by *Carpenters*, to Girdle the Tree in the middle, and take one fourth of that for the

the true Square, which is very false, for they shall loose in a Tree which is not above 50 Inches Circumference, one fifth of the true Content, and the Larger the Tree, the greater the Loss.

They pretend that the loss in the Measure is an Allowance for the *Chips* or *Slabs*, to bring it to a true Square; but still this cannot prove it neither according to Art, nor Truth, for you are to find the true Content, and make your Bargain accordingly.

I shall here lay down a true and exact method, the which if you Practice, you will find it both Easy, Just, and according to Art.

Before I proceed any further, I shall show you the way to find the *Square* of the *Gauge Point* for *Round Timber*; and then how you shall use it.

You are to Multiply the Divisor for finding the Square Inches in a Circle, *viz.* 1.27 5 by the Square Inches in a Cubical, or Solid Foot, *viz.* 1728, and the Product is the *Square* of the *Gauge Point*, the *Root* whereof is the *Gauge Point*, or 46.9.

Example.

1.2735
1728

101880
25470
89145
12735

2200.6080 (46.90
600
8460
9980

To prove this Work, Multiply the *Square* of the *Gauge Point*, viz. 2200.6080. by the *Area of Unity*, viz. .7853. and the Product will be 1728. 353, *&c.*

I shall in the next place shew you the use of the *Square* of the *Gauge Point*; as also the difference between it and the vulgar way, which is by the Rule of Proportion, as 14 is to 11, so is the Square of the Diameter to the Area in Square Inches.

Example

Example.

The Diameter of a Tree is 24.2

The Square of it is —— 585.64

11

58564
58564

14) 6342.04 (453.00
74
42
0004

This Quotient is the Square Inches, or Superficial Area of it, which must be Divided by 1728, and Multiplied by the Length, being 50, and the Product is the Content in Square Feet.

Example.

.1728) 452.00 .2621
10740 50
3720
2640 13.1050
912

I shall work the same Question by the Square of the *Gauge Point* in half the Figures, and more Exact.

The Square of the Diameter is

2200)	585.64	(.2662
	14764	50
	13640	
	4400	13.3100

Note, The Quotient is the *Area* or the *Content* of one Foot in Length of the Tree.

Suppose a Tree to be in *Circumference* at one end 46 Inches, at the other 34, and the middle 39, what's the Content in Square Feet, the length being 72 Inches.

You are to find the Diameters of each of the Places, by Multiplying the *Circumference* by each place severally, by .318, as before Directed, and one third of the Sum of the 3 Circumferences, is the mean Diameter, the Square whereof divided by 2200 Exhibits the *Area*, the which Multiply by the Length, and you have the *Content*.

Example.

Example.

	.318	.318	.318
Circumf	—46	-- 34	-- 39
	1908	1272	2862
	1272	954	954
	14.628	10.812	12.402
	10.812		
	12.402		
3)	37842	12.614	
	18	12.614	
	0042		
	12	50456	
		12614	
		75684	
		25228	
		12614	
	2200)	159012996	(072279
		5012	
		6129	
		17299	
		18996	
		1396	

These few *Examples* are sufficient for the Learner, being there is so few varieties

rieties in *Round Timber.* Only obſerve, if it be a *growing Tree*, to take the *Circumference*, about the middle of the Boole of it; for they are commonly ſomewhat Taper; but if it be a *Cut Tree*, you need not trouble your ſelf much with the *Circumference*, but take the *Diameter* of each end, (if the Tree be not Irregular) and half the Sum is the *Mean Diameter.*

I ſhall hereunto Annex a *Table* which by taking the *Compaſs* of the Tree, you may find the *Content* by inſpection of one Foot in Length, the which Multiply'd by the whole Length gives you the Content of the whole Tree.

The Uſe of the TABLE.

You will find the Compaſs of the Tree under Com. *and over-againſt it under* Foot *and* Parts, *you will find the Content of one Foot in Length.*

Example.

There is a piece of Timber 48 *Inches in Compaſs, and* 20 *Foot long, I find to be* 25 Foot, *and* 460 *Parts, for* 48 *Inches in Compaſs, gives* 1.273, *which Multiply'd by* 20, *gives* 25.460 *Foot.*

A Table which by the Compass of any piece of round Timber shews the true Content of one foot in Length thereof.

Inches of the Compass.

Co.	F. pa.	Co.	F. pa.	Com.	F. pa.
10	0.055	40	0.537	70	2.707
11	0.066	41	0.929	71	2.795
12	0.079	42	0.974	72	2.864
13	0.093	43	1.021	73	2.945
14	0.108	44	1.070	74	3.026
15	0.124	45	1.119	75	3.108
16	0.141	46	1.169	76	3.191
17	0.159	47	1.220	77	3.276
18	0.179	48	1.273	78	3.362
19	0.200	49	1.327	79	3.449
20	0.221	50	1.381	80	3.537
21	0.243	51	1.437	81	3.625
22	0.267	52	1.496	82	3.715
23	0.292	53	1.552	83	3.807
24	0.318	54	1.612	84	3.866
25	0.343	55	1.671	85	3.990
26	0.374	56	1.732	86	4.084
27	0.403	57	1.795	87	4.183
28	0.433	58	1.860	88	4.279
29	0.465	59	1.923	89	4.377
30	0.497	60	1.988	90	4.475
31	0.531	61	2.056	91	4.576
32	0.566	62	2.134	92	4.677
33	0.602	63	2.193	93	4.780
34	0.639	64	2.264	94	4.882
35	0.677	65	2.335	95	4.987
36	0.716	66	2.407	96	5.093
37	0.756	67	2.480	97	5.200
38	0.798	68	2.555	98	5.307
39	0.840	69	2.631	99	5.526
				100	5.614

Of

Of Weights.

There are two ſorts of Weights uſed by us in *England*, the one is called *Troy*, and the other *Aveir-du-pois*.

24 Grains of Wheat, makes a Penny Weight.
20 Penny Weight an *Ounce*.
12 Ounces a Pound. ——— } *Troy.*
480 Grains in an Ounce.
5760 Grains in a Pound

This is the Statutory weight for Silver, Gold and Bread.

The Apothecaries alſo uſe this weight, only they Divide the Ounces into other Denominations, viz.

20 Grains make a Scruple.
3 Scruples make a Dram.
8. Drams make an Ounce:
12. Ounces make a Pound.

So that in this Ounce there is alſo 480 Grains, therefore it muſt needs be the ſame with the other.

Avoir-du-Pois.

112 Pound is an hundred weight.

56 Half an hundred.
28 The Quarter of an hundred.
14 Half a Quarter.
1 Pound is 16 Ounces.
Half a Pound is 8 Ounces.
A quarter of a pound is 4 Ounces.
1 Ounce is 16 Drams.
Half an Ounce is 8 Drams.
A quarter of an Ounce is 4 Drahms.

Of Liquid Measure.

	Pints	Qu.	Pot.
In one Gallon are	8	4	2
One Pottle	4	2	1
In one Quart	2	1	0

Beer Vessels.

	Pints	Qu.	Potl.	Gal.
A Barrel of Beer is	288	144	72	36
A Kilderkin	144	72	36	18
A Firkin	72	36	18	9

Ale-Vessels.

	Pints	Qu.	Potl.	Gal.
A Barrel is	256	128	64	32
A Kilderkin is	128	64	32	16
A Firkin	64	32	16	8

Wine-

Wine Veſſels.

	Pints	Qu	Pttl.	Gal.
A Tun is	2016.	1008	504	252
A Pipe or Butt	1008	504	252	126
A Punchion	672	336	168	84
A Hogshead	504	252	126	63
A Tierce	336	168	84	42
Half-Hogshead	252	126	63	31½
A Rundlet	144	72	36	18

Of Dry Meaſure.

Corn is Meaſured by Gallons, but the Corn Gallon is different to the Wine or Ale-gallons, for it is a medium between both, being in Proportion as 28.33.25. The Names and Contents are as follows.

	A Laſt.	*Qu.*	*Strike*	*Buſhel*
Pints	5120	512	128	64
Quarts	2560	256	64	32
Pottles	1280	128	32	16
Gallons	640	64	16	8
Pecks	320	32	8	4
Buſhels	80	8	2	1
Strikes	40	4	1	0
Quarters	10	1	0	0

Of GOLD.

		l.	*s.*	*d.*	*q.*
One Pound	*Troy is worth*	40	0	0	0
One Ounce		3	6	8	0
One Penny weight.		0	3	4	0
One Grain		0	0	1	2

Of Silver.

		l.	*s*	*d.*	*q.*
One Pound of Silver	*Troy, is worth.*	3	0	0	0
One Ounce		0	5	0	0
One penny weight		0	0	3	0
One Grain		0	0	0	'

This is the Price of ordinary Gold, Angel Gold is worth somewhat more and Soveraign less.

Of Englisb Coin, Gold *or* Silver.

		l.	*s.*	*d.*	*q.*
Of Gold	1 *l. Troy weight is worth* ——	40	18	4	3
Of Silver		3	2	0	0
The same weight Avoir-du.		49	13	8	1
		3	15	3	2

Con-

Consequently 100 *l.* of *Silver* Mony weighs 26 *l.* 9 *Ounces Avoir-du-pois*, and 100 *l.* in *Gold* weighs 2 Pounds *Avoir-du-pois*, and about a Quarter of an *Ounce*.

As Gold is more in Worth, so it is more in Weight than any other Metal; for if you should take 7 Balls of these several Metals, their weights will have this Proportion one to the other.

Gold	10000
Quick-Silver will be but	7143
Lead	6053
Silver	5437
Brass	4737
Iron	4210
Tin	3895

Hence there may be a good Experiment made for trying Gold or Silver.

The *Ounce Troy* of Water is one Inch, and .89 parts of Solid Measure.

The Ounce *Avoir-du Pois* is one Inch .72 parts.

The

The *Pound Troy* of Water is 22 Inches and 73 parts.

The Pound *Avei du-Pois* is 27 Inches 60 parts.

A Foot Square of Water is 902 Ounces *Troy Weight*, which is 76 Pound. And the same in *Avoir-du-pois* is 62 Pound 9 Ounces, 6 Drahms and an half.

Of Longitude, &c.

3 Barly Corns make an Inch.
12 Inches make a Foot.
3 Foot make a Yard.
1 Yard and a Quarter makes an Ell.
16 Foot and an half make a Pole or Pearch.
40 Poles make a Furlong.
3 Furlongs make a Mile.
60 Miles is a Degree.

So that in a Measured Mile there is

Poles	320
Yards	1760
Feet	5280
Inches	63360
Barly Corns	190080

But the Miles between place and place

place are commonly more, unleſs it be within 20 Miles of *London*.

Of Time.

60 Minutes is an Hour.
24 Hours is a Day.
7 Days is a Week.
4 Weeks in a Month
13 Months in a year.

CHAP. VIII.

Of Land Measure.

LAnd is Measured generally by a Pole, Pearch or Rod, which is 16 Foot and an half long.

According to Statute 4 Poles in Breadth, and 40 in Length makes an Acre. So that one Acre Contains 160 Square Poles; half an Acre contains 80, a Quarter, or a Rod contains 40.

Some use Chains of 4 Poles Long, and are Divided according to fancy. I shall only shew you how to do it by Poles.

Since every Parcel of Land hath almost a different form. I shall here shew you how to Measure some of the most General, and then to reduce the others thereunto.

First, I shall shew you how to Measure a Square Piece of Land.

To

To Measure a Square piece of Land.

You are, according to the foregoing Rule of Measuring, Board to Multiply the Length by the Breadth, and the Product is the Content in Square Poles; the which Divide by 160, and the Quotient is the Acres.

Thus, suppose a Piece of Land to be 40 Poles in Length, and 20 in Breadth.

Length 40
Breadth 20

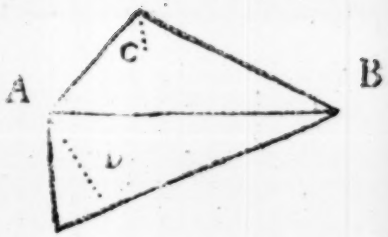
160) 800 (5 *Acres Just.*

There is not one piece of Land in an hundred Square or Oblong; but are somewhat Irregular. In such cases you are to reduce them into Triangles, and so Measure as in the following *Example.*

Secondly, There is a piece of Land in the following form.

Example.

Example.



The difference between A and B, the Common Base 170 Poles, the Perpendicular C, is 80 Poles, the Perpendicular *D* 90. What's the Content in Acres.

By the Doctrine of *Triangles* you are to Multiply the Sum of the Common Base, by half the Sum of the Perpendiculars, and the Product is the Superficial Content in Square Poles; the which Divide by 160, the Square Poles in an Acre, the Quotient is the Content in Square Acres.

The common Base	170
Half the Sum of the Perpendicular.	85
	850
	1360
The Superficial Poles	14450

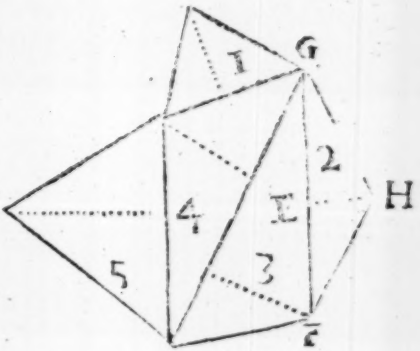
160) 14450 (90.3
500
20

The Content of the foregoing Figure is 90 Acres, and above one fourth of an Acre.

From this you may know how to Measure [illegible] the general Rule is to Measure the whole Base by half the Perpendicular, or half the Base by the whole Perpendicular. The Perpendicular is a Line drawn from the Obtuse Angle, touching the nigheſt oppoſite part of the Baſe.

Thirdly, ſuppoſe a piece of Land to be irregular, as the following Figure,

gure, you are to divide it into *Triangles*, so that the Number of *Triangles* may be two less than the Number of Sides.



You must find the Content of the 5 *Triangles* Severally, according to the foregoing Rule, and add all their Products together, and that Sum is the Content of the Field.

Example

Example.

Suppose the Content of the first *Triangle* to be.

1	160.	Poles
2	150.	
3	202.3	
4	203	
5	297	

Sum — 1092.3

The Sum of the 5 *Triangles* being 1092.3 Square Poles, I Divide by 160, and the Quotient is the Content in Square Acres. See the Work.

160) 1092.3 (6.2
323
.03

The Content of the foregoing Field is 6 Acres, and nigh a fourth of an Acre, or $\frac{2}{10}$.

The manner of taking the Dimenſions of an Irregular Field.

According to the foregoing Rule, you are to Divide the Field into ſeveral *Triangles*, they being leſs in number by two than the ſides of the Field betwixt Angle and Angle; and to let fall Perpendiculars from the Angles upon the nigheſt place of the Baſe, which is a ſtraight Line from the Angle, which you ſtand, or is ſuppoſed to ſtand at, to the oppoſite Angle, as the Line F, G, in the foregoing irregular Figure.

To perform this work, there muſt be two perſons at leaſt; the one muſt ſtand at the Angle F, (ſuppoſe we were to take the Dimenſions of the *Triangle* F, G, H) and the other muſt go as ſtreight as he can towards the Angle G. Now he that ſtands at the Angle F, may eaſily diſcern if he ſwerves to the right or left, and muſt direct him, that being his part of the Work. He that walks from F, towards G, muſt diligently obſerve when he comes oppoſite to the Angle H, and there make a mark as E. Then you are

with

with your Chain (of four or more Poles long, each Pole being Divided into Decimals parts, *viz.* Ten equal Links, each Link being one Tenth of a Pole) to Meaſure from E, H, which is the Perpendicular. Then you are to return to F, and from thence Meaſure with your Chain to G, by the way of E, which is the Baſe; the party ſtanding at F, obſerving the others Motion. In like manner you are to take the Dimenſions of all the reſt of the field, and by the foregoing Rule, to find the Content of the ſeveral Triangles, and the Sum of them all is the Content of the field.

The

THE True Method OF BREWING STRONG ALE;

Such as

York, *Nottingham*, *Lincoln*, &c.

With a true way of Refining them.

LONDON,
Printed for *John Everingham*, at the *Star* in *Ludgate-street*, 1694.

THE

True Method

OF

BREWING

STRONG ALE,

Such as *York*, *Notingham*, *Lincoln*, &c. *With the true way of refining them.*

SOME are of Opinion that it is the difference in the Malt that Cauſes the great difference between *London*, *Yorkſhire* and *Notingham* ALES, but they are under a miſtake herein; for moſt Men know that there is as good Barly grows

here in the *South*, as in any place in *England*, and by consequence, they may have as good Malt. Others impute it to to the Water; but the Advantage lies in neither of these, but merely in the Brewing and well ordering of it.

The manner of their Working.

First, To one Quarter of Malt you are to allow Seventy five Gallons of Liquor, or River Water, letting boyl it for one hour, and so proportionably for a greater or lesser Quantity. And to every Quarter of Malt, half a Pound of Hops.

Then having your Malt ready in your Mash-Tun, you are to pour so much Liquor upon it as will wet it quite through; in so much that the Mask may be raised in the Tun a considerable height. Then Cover it up, with Cloaths for that purpose, very Close for two Hours, preserving the remaining part of the Liquor very Hot in the Copper, if not Boyling.

Secondly,

Secondly, When you think the two hours is expir'd, work your Mash with Instruments for that purpose very well till you can discern no dry Malt in the Mash. When you have so done, let go your Mash Tun very gently, gathering your Worts in a Convenient Vessel. And when you have let go about half an Hour, or there about, according to the largeness of your Mask, you are to Leak on, as they Term it, the remaining part of the Liquor, with a Pale or something fit for the purpose, throwing it all over the Mash by degrees.

Thirdly, When all your Worts are gathered, and Emptied (from the Vessel wherein you have gathered it) into your Copper, and your Hops put therein, you are to Boyl it three Hours at least; Then empty it from your Copper into your Back or Cooler.

Fourthly, While your Worts are Milk Warm, you are to Clear it into your Guile-Tun, while it runs

free from Dregs or Sediment, (and if you please) you may, by putting your Dregs into a Flannel Bag, drain a Considerable Quantity of fine Clear Liquor from them, which are certainly the strongest part of the Worts.

Fifthly, To your Worts, (the common Lengths being there 54 Gallons from a Quarter of Malt) put two Quarts of good Yeast, or Barm, and let it work for 24 Hours, beating it in, or working your Guile, Three or four times a day, according to the Bigness of your Tun, or Season of the Year, the Winter requiring a great deal of Care.

When your Guile is well wrought Tun it up into well seasoned Vessels, leaving Room for it to work for about half a day, then Bong the Cask up very close.

If you let your Cask stand four, five, or Ten weeks in that manner without disturbance by removing or otherways, your Drink will be exceeding Strong and Fine.

If

If at any time it ſhould happen that your Guile do not work, but that either by letting it work too long, or by reaſon of ſome accident, the Yeaſt may fall to the Bottom, and ſo your Guile be ſpoiled, in ſomuch, that without a proper remedy you may looſe the whole. In ſuch caſe you are to uſe the means following.

Take half a Quartern of *Brandy*, and the Whites of two Eggs, and beat them very well together, and Power them into your Guile; or if your Drink be in the Casks, Power it into the *Bong*, laying a warm Cloath over either your Guile-Tun or Cask; and in leſs than an Hours time it will work as brisk as at firſt. Obſerve to underlay your Cloath that you Cover your Guile-Tun or Cask with, ſo that it may have

room

room to begin to Work, then take the Cloath off.

Another way.

Take two Ounces of fine Loaf Sugar, a quarter of an Ounce of Good Powder of *Ziniziber*, and mix them very well with ſome of the Liquor, being warm, and uſe it as aforeſaid.

A way to Clear Ale *or* Beer *if it be never ſo Thick or Muddy.*

Take half an Ounce of Unſleckt Lime, and one Pint of Water, mix them together very well, and let it ſtand for three hours, and the Lime will ſettle to the bottom, and the Water will be as Clear as Chriſtial; take this Water

ter, being pured from the Sedement, and put into your Ale or Beer, with half an ounce of Izing-Glafs well boyled, and in lefs than four hours time the Drink will be fettled and Clear.

This quantity will ferve a Hogshead of Drink.

A

TABLE

OF

CYLINDERS

In Ale Gallons.

From 12 to 36 Inches in Diameter, and 30 Inches in Depth, Calculated to every two Tenths of an Inch in Diameter, and every two Tenths of an Inch in Depth; of Excellent Use for all Gaugers.

Cylinders *in Ale-Gallons.*

	12	.1	.3	.5	.7	.9
.1	0.04	0.04	0.04	0.04	0.04	0.05
.3	0.12	0.12	0.18	0.13	0.13	0.14
.5	0.20	0.20	0.21	0.22	0.22	0.23
.7	0.28	0.29	0 29	0.30	0.31	0.32
.9	0.36	0.37	0.38	0.39	0.40	0.42
Area.	2.40	0.41	0.42	0.44	0.45	0.46
2	0.80	0.82	0.84	0.87	0.90	0.93
3	1.20	1.22	1.26	1.31	1.35	1.39
4	1.60	1.63	1.69	1.74	1.80	1.85
5	2.01	2.04	2.11	2.18	2.25	2.32
6	2.41	2 45	2.53	2.61	2.70	2.78
7	2.81	2.85	2.95	3.05	3.14	3.24
8	3.21	3.26	3.37	3.48	3.59	3.71
9	3.61	3.67	3.79	3.92	4.04	4.17
10.	4.01	4.08	4.21	4.35	4.49	4.63
11	4.41	4.49	4.64	4.79	4.94	5.10
12	4.81	4.89	5.06	5.22	5.39	5.56
13	5.21	5.30	5.48	5.66	5.84	6.03
14	5.62	5.71	5.90	6.09	6.29	6.49
15	6.02	6.12	6.32	6.53	6.74	6.95
16	6.42	6.52	6.74	6.96	7.19	7.42
17	6.82	6.93	7.16	7.40	7.64	7.88
18	7.22	7.34	7.59	7.83	8.09	8.34
19	7.62	7.75	8.01	8.27	8.53	8.81
20	8.02	8.16	8 43	8.70	8.98	9.27
21	8.42	8.56	8.85	9.14	9.43	9.73
22	8.82	8.97	9.27	9.57	9.88	10.20
23	9.23	9.38	9.69	10.01	10.33	10.66
24	9.63	9.79	10.11	10.44	10.78	11.12
25	10.03	10.19	10.54	10.88	11.23	11.59
26	10.43	10.60	10.96	11.32	11.68	12.05
27	10.83	11.01	11.38	11.75	12.13	12.51
28	11.23	11.42	11.80	12.19	12.58	12.98
29	11.63	11.83	12.22	12.62	13.03	13.44
30	12.03	12.23	12.64	13.06	13.48	13.90

Cylinders *in Ale Gallons.*

	13	.1	.3	.5	.7	.9
.1	0.05	0.05	0.05	0.05	0.05	0.05
.3	0.14	0.15	0.15	0.15	0.16	0.16
.5	0.24	0.24	0.25	0.25	0.26	0.27
.7	0.38	0.33	0.34	0.36	0.37	0.38
.9	0.42	0.43	0.44	0.45	0.47	0.48
Area.	0.47	0.48	0.49	0.51	0.52	0.54
2	0.94	0.96	0.98	1.02	1.05	1.08
3	1.41	1.44	1.48	1.52	1.57	1.61
4	1.89	1.91	1.97	2.03	2.09	2.15
5	2.35	2.39	2.46	2.54	2.62	2.69
6	2.82	2.87	2.95	3.05	3.14	3.23
7	3.29	3.35	3.45	3.55	3.66	3.77
8	3.77	3.82	3.94	4.06	4.18	4.30
9	4.24	4.30	4.44	4.57	4.70	4.84
10	4.71	4.78	4.93	5.08	5.23	5.38
11	5.18	5.26	5.42	5.56	5.75	5.92
12	5.65	5.74	5.91	6.09	6.27	6.46
13	6.12	6.21	6.41	6.60	6.79	7.00
14	6.59	6.69	6.90	7.11	7.32	7.53
15	7.06	7.17	7.39	7.61	7.84	8.07
16	7.53	7.65	7.89	8.12	8.36	8.61
17	8.00	8.13	8.38	8.63	8.89	9.15
18	8.47	8.60	8.87	9.14	9.41	9.69
19	8.94	9.08	9.36	9.64	9.93	10.22
20	9.41	9.56	9.86	10.15	10.45	10.76
21	9.88	10.04	10.35	10.66	10.98	11.30
22	10.35	10.52	10.84	11.17	11.50	11.84
23	10.83	10.99	11.34	11.67	12.02	12.38
24	11.30	11.47	11.83	12.18	12.54	12.91
25	11.77	11.95	12.32	12.69	13.07	13.45
26	12.24	12.43	12.82	13.20	13.59	13.99
27	12.71	12.91	13.31	13.71	14.11	14.53
28	13.18	13.38	13.80	14.21	14.64	15.07
29	13.65	13.86	14.29	14.72	15.16	15.60
30	14.12	14.34	14.79	15.23	15.68	16.14

Cylinders *in Ale Gallons.*

	.14	.1	.3	.5	.7	.9
.1	0.05	0.05	0.05	0.06	0.06	0.06
.3	0.16	0.17	0 17	0.18	0.18	0.19
.5	0.27	0 28	0.28	0.29	0.30	0.31
.7	0.38	0.39	0.40	0 41	0.42	0.43
.9	0.49	0.50	0.51	0.53	0.53	0.26
Area.	0.54	0.55	0.57	0.59	0.60	0.62
2	1.09	1.11	1.14	1.17	1.20	1.24
3	1.64	1.66	1.17	1.76	1.80	1.84
4	2.18	2.21	2.28	2.34	2.41	2.47
5	2.73	2.77	2.85	2.93	3.00	3.09
6	3.27	3.32	3.42	3.51	3.61	3.71
7	3.82	3.88	3.99	4.10	4.21	4.33
8	4.37	4 43	4.56	4.65	4.81	4.94
9	4.91	4.98	5.13	5.27	5.42	5.56
10	5.46	5.54	5.70	5.86	6.02	6.18
11	6.00	6.09	6.26	6.44	6.62	6.80
12	6.55	6.64	6.83	7.03	7.22	7.42
13	7.10	7.20	7.40	7.61	7.82	8.04
14	7.64	7.25	7.97	8.20	8.42	8.65
15	8.19	8.31	8.54	8.78	9.03	9.27
16	8.73	8.86	9.11	9.37	9.63	9.89
17	9.28	9.41	9.68	9.96	10.23	10.51
18	9.83	9.97	10.25	10.54	10.83	11.13
19	10.37	10.52	10.82	11.13	11.43	11.74
20	10.91	11.07	11.39	11.71	12.04	12.36
21	11.46	11.63	11.96	12.30	12.64	12.98
22	12.01	12.18	12.53	12.88	13.24	13.60
23	12.55	12.13	13.19	13.47	13.83	14.22
24	13.10	13.29	13.67	14.06	14.46	14.83
25	13.65	13.84	14.24	14.64	15.07	15.45
26	14.19	14.40	14.81	15.23	15.65	16.07
27	14.74	14.95	15.38	15.81	16.27	16.69
28	15.28	15.50	15.95	16.40	16.86	17.31
29	15.83	16.05	16.52	16.98	17.46	17.92
30	16.38	16.61	17.08	17.55	18.06	18.54

Cylinders *in Ale-Gallons.*

	.15	.1	.3	.5	.7	.9
.1	0.06	0.06	0.06	0.07	0.07	0.07
.3	0.19	0.19	0.20	0.20	0.21	0.21
.5	0.31	0.32	0.33	0.33	0.34	0.35
.7	0.44	0.44	0.46	0.47	0.48	0.49
.9	0.56	0.57	0.59	0.60	0.62	0.63
Area.	0.63	0.63	0.65	0.67	0.69	0.70
2	1.25	1.27	1.30	1.34	1.37	1.41
3	1.88	1.90	1.96	2.01	2.05	2.11
4	2.51	2.54	2.61	2.68	2.74	2.82
5	3.13	3.17	3.26	3.35	3.43	3.52
6	3.76	3.81	3.91	4.01	4.12	4.22
7	4.39	4.44	4.56	4.68	4.81	4.93
8	5.01	5.08	5.22	5.35	5.49	5.63
9	5.64	5.71	5.87	6.02	6.48	6.34
10	6.27	6.35	6.52	6.69	6.86	7.04
11	6.89	6.98	7.17	7.36	7.55	7.74
12	7.52	7.62	7.82	8.03	8.24	8.45
13	8.15	8.25	8.48	8.70	8.92	9.15
14	8.77	8.89	9.13	9.37	9.61	9.86
15	9.40	9.52	9.78	10.04	10.30	10.56
16	10.03	10.16	10.43	10.71	10.98	11.27
17	10.65	10.79	11.08	11.37	11.67	11.97
18	11.28	11.43	11.74	12.04	12.36	12.67
19	11.91	12.06	12.39	12.71	13.04	13.38
20	12.53	12.70	13.04	13.38	13.73	14.08
21	13.16	13.33	13.69	14.05	14.42	14.79
22	13.78	13.97	14.34	14.72	15.10	15.49
23	14.41	14.60	15.00	15.39	15.79	16.19
24	15.04	15.24	15.65	16.06	16.48	16.90
25	15.66	15.87	16.30	16.71	17.16	17.60
26	16.29	16.51	16.95	17.40	17.85	18.31
27	16.92	17.14	17.60	18.07	18.44	19.01
28	17.54	17.78	18.26	18.73	19.22	19.71
29	18.17	18.41	18.91	19.40	19.91	20.42
30	18.80	19.05	19.56	20.07	20.59	21.12

Cylinders *in Ale-Gallons.*

	.16	.1	.3	.5	.7	.9
.1	0.07	0.07	0.07	0.08	0.08	0.08
.3	0.22	0.22	0.22	0.23	0.23	0.24
.5	0.39	0.96	0.37	0.38	0.39	0.40
.7	0.50	0.50	0.52	0.53	0.54	0.56
.2	0.65	0.65	0.67	0.68	0.70	0.70
Area.	0.71	0.72	0.74	0.76	0.78	0.80
2	1.48	1.44	1.48	1.52	1.55	1.59
3	2.14	2.17	2.22	2.27	2.33	2.39
4	2.85	2.89	2.96	3.03	3.11	3.18
5	3.56	3.61	3.70	3.79	3.88	3.98
6	4.28	4.33	4.44	4.55	4.66	4.77
7	4.99	5.05	5.18	5.31	5.44	5.57
8	5.70	5.77	5.92	6.07	6.21	6.36
9	6.42	6.50	6.66	6.82	6.99	7.16
10	7.13	7.22	7.40	7.58	7.77	7.95
11	7.84	7.94	8.14	8.34	8.54	8.75
12	8.56	8.66	8.88	9.90	9.32	9.55
13	9.27	9.38	9.62	9.86	10.10	10.34
14	9.98	10.11	10.36	10.61	10.87	11.14
15	10.69	10.83	11.10	11.37	11.65	11.93
16	11.41	11.55	11.84	12.13	12.43	12.73
17	12.12	12.27	12.58	12.89	13.20	13.52
18	12.83	12.99	13.32	13.65	13.98	14.32
19	13.55	13.72	14.06	14.41	14.76	15.11
20	14.26	14.44	14.80	15.16	15.53	15.91
21	14.97	15.16	15.54	15.92	16.31	16.71
22	15.69	15.88	16.28	16.68	17.09	17.50
23	16.40	16.60	17.02	17.44	17.86	18.30
24	17.15	17.33	17.76	18.20	18.64	19.09
25	17.82	18.05	18.50	18.95	19.42	19.80
26	18.54	18.77	19.24	19.71	20.99	20.68
27	19.25	19.49	19.98	20.47	20.97	21.48
28	19.96	20.21	20.42	21.23	21.75	22.27
29	20.68	20.93	21.46	21.99	22.52	23.07
30	21.39	21.66	22.20	22.75	23.30	23.86

Cylinders *in Ale Gallons.*

	.17	.1	.3	.5	.7	.9
.1	0.08	0.08	0.08	0.09	0.09	0.09
.3	0.24	0.24	0.25	0.25	0.26	0.27
.5	0.40	0.41	0.42	0.43	0.44	0.45
.7	0.26	0.57	0.58	0.60	0.61	0.62
.9	0.72	0.73	0.75	0.77	0.78	0.80
Area.	0.80	0.81	0.83	0.85	0.87	0.89
2	1.61	1.63	1.67	1.71	1.74	1.78
3	2.41	2.44	2.50	2.56	2.62	2.68
4	3.22	3.26	3.33	3.41	3.49	3.57
5	4.02	4.07	4.17	4.26	4.36	4.46
6	4.82	4.89	5.00	5.12	5.23	5.35
7	5.63	5.70	5.83	5.97	6.11	6.25
8	6.44	6.51	6.67	6.82	6.98	7.14
9	7.24	7.33	7.50	7.68	7.80	8.03
10	8.05	8.14	8.34	8.53	8.72	8.92
11	8.85	8.96	9.17	9.38	9.60	9.82
12	9.66	9.77	10.00	10.23	10.47	10.71
13	10.46	10.59	10.84	11.09	11.34	11.60
14	11.27	11.40	11.67	11.94	12.21	12.49
15	12.07	12.22	12.50	12.79	13.09	13.39
16	12.88	13.03	13.34	13.65	13.96	14.28
17	13.68	13.84	14.17	14.55	14.83	15.17
18	14.49	14.66	15.00	15.35	15.70	16.06
19	15.29	15.47	15.84	16.20	16.58	16.95
20	16.10	16.29	16.67	17.06	17.45	17.84
21	16.90	17.10	17.51	17.91	18.32	18.73
22	17.71	17.92	18.34	18.76	19.19	19.62
23	18.51	18.73	19.17	19.62	20.07	20.52
24	19.32	19.55	20.01	20.47	20.94	21.41
25	20.12	20.36	20.84	21.32	21.81	22.30
26	20.93	21.17	21.67	22.18	22.68	23.29
27	21.73	21.99	22.51	23.03	23.56	24.09
28	22.54	22.80	23.34	23.88	24.43	24.98
29	23.34	23.60	24.17	24.73	25.30	25.87
30	24.15	24.43	25.01	25.59	26.17	26.79

Cylinders *in Ale Gallons.*

	.18	.1	.3	.5	.7	.9
.1	0.09	0.09	0.09	0.10	0.10	0.10
.3	0.27	0.27	0.28	0.29	0.29	0.30
.5	0.45	0.46	0.47	0.48	0.49	0.50
.7	0.63	0.64	0.65	0.67	0.68	0.70
.9	0.87	0.82	0.84	0.86	0.88	0.90
Area.	0.90	0.91	0.93	0.95	0.97	0.99
2	1.80	1.82	1.87	1.91	1.95	1.19
3	2.71	2.74	2.80	2.86	2.92	2.18
4	3.61	3.64	3.73	3.81	3.90	3.98
5	4.57	4.56	4.66	4.77	4.87	4.97
6	5.41	5.47	5.60	5.72	5.84	5.97
7	6.32	6.59	6.53	6.67	6.82	6.96
8	7.22	7.30	7.46	7.63	7.79	7.96
9	8.12	8.21	8.39	8.58	8.76	8.95
10	9.02	9.12	9.33	9.53	9.74	9.85
11	9.93	10.04	10.26	10.49	10.71	10.94
12	10.83	10.95	11.19	11.44	11.69	11.94
13	11.73	11.86	12.12	12.39	12.66	12.93
14	12.63	12.77	13.06	13.34	13.65	13.93
15	13.54	13.69	13.99	14.30	14.61	14.92
16	14.44	14.60	14.92	15.25	15.58	15.92
17	15.34	15.51	15.86	16.20	16.56	16.91
18	16.24	16.42	16.79	17.16	17.53	17.91
19	17.15	17.34	17.72	18.11	18.50	18.90
20	18.05	18.25	18.65	19.06	19.48	19.90
21	18.95	19.16	19.59	20.02	20.45	20.89
22	19.85	20.07	20.52	20.97	21.42	21.89
23	20.76	20.99	21.45	21.92	22.40	22.88
24	21.66	21.90	22.38	22.88	23.37	23.88
25	22.56	22.81	23.32	23.83	24.35	24.87
26	23.46	23.72	24.25	24.78	25.32	25.87
27	24.36	24.63	25.18	25.74	26.30	26.85
28	25.27	25.55	26.15	26.69	27.27	27.86
29	26.17	26.46	27.05	27.64	28.24	28.85
30	27.07	27.37	27.98	28.60	29.22	29.85

Cylinders *in Ale Gallons.*

	.17	.1	.3	.5	.7	.9
.1	0.08	0.08	0.08	0.09	0.09	0.09
.3	0.24	0.24	0.25	0.25	0.26	0.27
.5	0.40	0.41	0.42	0.43	0.44	0.45
.7	0.26	0.57	0.58	0.60	0.61	0.62
.9	0.72	0.73	0.75	0.77	0.78	0.80
Area.	0.80	0.81	0.83	0.85	0.87	0.89
2	1.61	1.63	1.67	1.71	1.74	1.78
3	2.41	2.44	2.50	2.56	2.62	2.68
4	3.22	3.26	3.33	3.41	3.49	3.57
5	4.02	4.07	4.17	4.26	4.36	4.46
6	4.82	4.89	5.00	5.12	5.23	5.35
7	5.63	5.70	5.83	5.97	6.11	6.25
8	6.44	6.51	6.67	6.82	6.98	7.14
9	7.24	7.33	7.56	7.68	7.80	8.03
10	8.05	8.14	8.34	8.53	8.72	8.92
11	8.85	8.96	9.17	9.38	9.60	9.82
12	9.66	9.77	10.00	10.23	10.47	10.71
13	10.46	10.59	10.84	11.09	11.34	11.60
14	11.27	11.40	11.67	11.94	12.21	12.49
15	12.07	12.22	12.50	12.79	13.09	13.39
16	12.88	13.03	13.34	13.65	13.96	14.28
17	13.68	13.84	14.17	14.55	14.83	15.17
18	14.49	14.66	15.00	15.35	15.70	16.06
19	15.29	15.47	15.84	16.20	16.58	16.95
20	16.10	16.29	16.67	17.06	17.45	17.84
21	16.90	17.10	17.51	17.91	18.32	18.73
22	17.71	17.92	18.34	18.76	19.19	19.62
23	18.51	18.73	19.17	19.62	20.07	20.52
24	19.32	19.55	20.01	20.47	20.94	21.41
25	20.12	20.36	20.84	21.32	21.81	22.30
26	20.93	21.17	21.67	22.18	22.68	23.29
27	21.73	21.99	22.51	23.03	23.56	24.09
28	22.54	22.80	23.34	23.88	24.43	24.98
29	23.34	23.60	24.17	24.73	25.30	25.87
30	24.15	24.43	25.01	25.59	26.17	26.79

Cylinders *in Ale Gallons.*

	.18	.1	.3	.5	.7	.9
.1	0.09	0.09	0.09	0.10	0.10	0.10
.3	0.27	0.27	0.28	0.29	0.29	0.30
.5	0.45	0.46	0.47	0.48	0.49	0.50
.7	0.63	0.64	0.65	0.67	0.68	0.70
.9	0.87	0.82	0.84	0.86	0.88	0.90
Area.	0.90	0.91	0.93	0.95	0.97	0.99
2	1.80	1.82	1.87	1.91	1.95	1.19
3	2.71	2.74	2.80	2.86	2.92	2.18
4	3.61	3.64	3.73	3.81	3.90	3.98
5	4.57	4.56	4.66	4.77	4.87	4.97
6	5.41	5.47	5.60	5.72	5.84	5.97
7	6.32	6.59	6.53	6.67	6.82	6.96
8	7.22	7.30	7.46	7.63	7.79	7.96
9	8.12	8.21	8.39	8.58	8.76	8.95
10	9.02	9.12	9.33	9.53	9.74	9.85
11	9.93	10.04	10.26	10.49	10.71	10.94
12	10.83	10.95	11.19	11.44	11.69	11.94
13	11.73	11.86	12.12	12.39	12.66	12.93
14	12.63	12.77	13.06	13.34	13.65	13.93
15	13.54	13.69	13.99	14.30	14.61	14.92
16	14.44	14.60	14.92	15.25	15.58	15.92
17	15.34	15.51	15.86	16.20	16.56	16.91
18	16.24	16.42	16.79	17.16	17.53	17.91
19	17.15	17.34	17.72	18.11	18.50	18.90
20	18.05	18.25	18.65	19.06	19.48	19.90
21	18.95	19.16	19.59	20.02	20.45	20.89
22	19.85	20.07	20.52	20.97	21.42	21.89
23	20.76	20.99	21.45	21.92	22.40	22.88
24	21.66	21.90	22.38	22.88	23.37	23.88
25	22.56	22.81	23.32	23.83	24.35	24.87
26	23.46	23.72	24.25	24.78	25.32	25.87
27	24.36	24.63	25.18	25.74	26.30	26.86
28	25.27	25.55	26.15	26.69	27.27	27.86
29	26.17	26.46	27.05	27.64	28.24	28.85
30	27.07	27.37	27.98	28.60	29.22	29.85

Cylinders *in Ale-Gallons.*

	.19	.1	.3	5.	.7	.9
.1	0.10	0.10	0.70	0.11	0.18	0.11
.3	0.30	0.30	0.31	0.32	0.24	0.33
.5	0.50	0.51	0.52	0.53	0.32	0.54
.7	0.70	0.71	0.78	0.74	0.40	0.77
.9	0.90	0.91	0.98	0.95	0.49	0.99
Area.	1.00	1.02	1.04	1.06	1.08	1.10
2	2.01	2.03	2.08	2.12	2.16	2.21
3	3.02	3.05	3.11	3.18	3.24	3.31
4	4.02	4.06	4.15	4.24	4.32	4.41
5	5.03	5.08	5.19	5.29	5.40	5.51
6	6.03	6.10	6.23	6.35	6.49	6.62
7	7.04	7.11	7.26	7.41	7.57	7.72
8	8.04	8.13	8.30	8.47	8.65	8.82
9	9.05	9.14	9.04	9.53	9.73	9.93
10	10.05	10.16	10.38	10.59	10.81	11.03
11	11.06	11.18	11.41	11.65	11.89	12.13
12	12.06	12.19	12.45	12.71	12.97	13.23
13	13.07	13.21	13.49	13.77	14.05	14.34
14	14.08	14.22	14.53	14.83	15.13	15.44
15	15.08	15.24	15.57	15.88	16.21	16.54
16	16.09	16.26	16.60	16.94	17.29	17.65
17	17.09	17.27	17.64	18.00	18.38	18.75
18	18.10	18.29	18.68	19.06	19.46	19.86
19	19.10	19.30	19.72	20.12	20.54	20.96
20	20.11	20.32	20.75	21.18	21.62	22.06
21	21.11	21.34	21.79	22.24	22.70	23.16
22	22.12	22.35	22.83	23.30	23.78	24.26
23	23.12	23.37	23.87	24.30	24.86	25.36
24	24.13	24.38	24.90	25.42	25.94	26.47
25	25.13	25.40	25.94	26.47	27.02	27.57
26	26.14	26.42	26.98	27.53	28.10	28.67
27	27.15	27.43	28.02	28.59	29.18	29.77
28	28.15	28.45	29.06	29.65	30.27	30.87
29	29.16	29.46	30.03	30.71	31.35	31.97
30	30.16	30.48	31.13	31.77	32.43	33.09

Cylinders *in Ale-Gallons.*

	.20	.1	.3	.5	.7	.9
.1	0.11	0.11	0.11	0.11	0.12	0.12
.3	0.33	0.34	0.34	0.35	0.36	0.36
.5	0.56	0.56	0.57	0.58	0.60	0.61
.7	0.78	0.79	0.80	0.82	0.84	0.85
.9	1.00	1.01	1.03	1.07	1.07	1.09
Area.	1.11	1.12	1.15	1.17	1.19	1.22
2	2.23	2.25	2.30	2.34	2.39	2.43
3	3.34	3.38	3.44	3.51	3.58	3.65
4	4.46	4.50	4.59	4 68	4.77	4.87
5	5.57	5.63	5.74	5.85	5.97	5.08
6	6.68	6.75	6.89	7.02	7.16	7.38
7	7.80	7.88	8.03	8.20	8.35	8.52
8	8.91	9.00	9.18	9.36	9.55	9.73
9	10.03	10.13	10.33	10.53	10.74	10.90
10	11.14	11.25	11.48	11.70	11.93	12.17
11	12.25	12.38	12.62	12.87	13.13	13.38
12	13.37	13.50	13.77	14.04	14.32	14.60
13	14.48	14.63	14.92	15.21	15.51	15.81
14	15.60	15.75	16.08	16.39	16.71	17.03
15	16.71	16.88	17.22	17.56	17.90	18.25
16	17.82	17.00	18.36	18.73	19.09	19.46
17	18.94	19.13	19.51	19.90	20.29	20.68
18	20.05	20.25	20.66	21.07	21.48	21.90
19	21.17	21.38	21.87	22.24	22.67	23.11
20	22.28	22.50	22.95	23.41	23.87	24.33
21	23.39	23.63	24.90	24.58	25.06	25.55
22	24.51	24.75	25.25	25.75	26.25	26.76
23	25.62	25.88	26.40	26.92	27.45	27.98
24	26.74	27.00	27.54	28.09	28.64	29.20
25	27.85	28.13	28.69	29.26	29.83	30.41
26	28.96	29.26	29.84	30.43	31.03	31.63
27	30.08	30.38	30.99	31 60	32.22	32.22
28	31.19	31.51	32.13	32.77	33.42	33.42
29	32.31	32.63	33.18	33.94	34.61	34.61
30	33.42	33.76	34.43	35.11	35.80	35.80

F Cylinders *in Ale Gallons.*

	.21	.1	.3	.5	.7	.9
.1	0.12	0.12	0.12	0.13	0.13	0.13
.3	0.37	0.37	0.38	0.39	0.39	0.40
.5	0.61	0.62	0.63	0.64	0.66	0.67
.7	0.86	8.87	0.88	0.90	0.92	0.93
.9	1.11	1.12	1.14	1.16	1.18	1.20
Area.	1.23	1.24	1.26	1.29	1.31	1.34
2	2.40	2.48	2.53	2.57	2.6	2.67
8	3.68	3.72	3.78	3.86	3.93	4.01
4	4.91	4.96	4.04	5.15	5.25	5.34
5	6.14	6.20	6.31	6.44	6.56	6.68
6	7.37	7.44	7.57	7.72	7.87	8.01
7	8.60	8 63	8.33	9.01	9.18	9.35
8	9.82	9.92	10.09	10.30	10.49	10.69
9	11.05	11.16	11.35	11.59	11.80	12.02
10	12.28	12.40	12.63	12.89	13.11	13.36
11	13.51	13.64	13.89	14.16	14.43	14.69
12	14.74	14.88	15.15	15.45	15.74	16.03
13	15.97	16.12	16.42	16.74	17.05	17.37
14	17.19	17.36	17.68	18.02	18.36	18.70
15	18.42	18.60	18.94	19.31	19.67	20.04
16	19.65	19.84	20.21	20.60	20.98	21.37
17	20.88	21.08	21.47	21.89	22.29	22.71
18	22.11	22.32	22.73	23.17	23.60	24.04
19	23.33	23.56	24.00	24.46	24.92	25.38
20	24.56	24.80	25.26	25.75	26.23	26.72
21	25.79	26.04	26.52	27.04	27.54	28.05
22	27.02	27.28	27.79	28.32	28.87	29.39
23	28.25	28.52	29.05	29.61	30.16	30.72
24	29.48	29.76	30.32	30.90	31.47	32.06
25	30.70	31.00	31.58	32.18	32.79	33.40
26	31.93	32.24	32.84	33.47	34.10	34.73
27	33.16	33.48	24.01	34.76	35.41	36.07
28	34.39	34.72	35.37	36.05	36.72	37.40
29	35.62	35.96	36.63	37.35	38.05	38.74
30	36.85	36.20	37.70	38.62	39.34	40.04

Cylinders *in Ale Gallons.*

	22	1.	·3	5.	·7	·9
·1	0.13	0.13	0.14	0.14	0.14	0.14
·3	0.40	0.41	0.42	0.42	0.43	0.44
·5	0.67	0.68	0.69	0.70	0.72	0.73
·7	0.94	0.95	0.97	0.99	1.01	1.02
·9	1.24	1.22	1.25	1.27	1.30	1.31
Area.	1.35	1.36	1.38	1.41	1.45	1.46
2	2.70	2.72	2.77	2.82	2.87	2.92
3	4.04	4.08	4.15	4.23	4.31	4.38
4	5.39	5.44	5.54	5.64	5.74	5.84
5	6.74	6.80	6.92	7.05	7.18	7.30
6	8.44	8.16	8.31	8.46	8.61	8.76
7	9.44	9.52	9.69	9.87	10.00	10.22
8	10.78	10.88	11.08	11.28	11.84	11.68
9	12.13	12.24	12.46	12.69	12.92	13.14
10	13.48	13.60	13.85	14.10	14.35	14.62
11	14.83	14.96	15.23	15.15	15.79	16.07
12	16.18	16.32	16.62	16.92	17.22	17.53
13	17.52	17.68	18.22	18.33	18.66	18.99
14	18.87	19.04	19.39	19.74	20.01	20.45
15	20.22	20.40	20.77	21.15	21.53	21.91
16	21.57	21.76	22.16	22.56	22.96	23.37
17	22.92	23.12	23.54	23.97	24.40	24.83
18	24.26	24.48	24.93	25.38	25.83	26.30
19	25.61	25.84	26.31	26.79	27.27	27.75
20	26.96	27.20	27.70	28.20	28.10	29.2
21	28.31	28.56	29.08	29.61	30.14	30.6
22	29.66	29.92	30.47	31.02	31.57	32.?
23	31.00	31.28	31.85	32.43	33.01	33.5
24	32.35	32.64	33.24	33.84	34.44	35.0
25	33.70	34.30	34.62	35.25	35.88	36.5
26	35.05	35.37	36.37	36.66	37.31	37.95
27	36.40	36.73	37.39	38.07	38.75	39.4
28	37.74	38.09	38.78	39.48	40.19	40.8
29	39.09	39.45	40.16	40.90	41.62	42.3
30	40.44	40.81	41.55	42.30	43.05	43.8

Cylinders to Gallons.

	.23	.1	.3	.5	.7	.9
.1	0.15	0.15	0.15	0.15	0.15	0.16
.3	0.44	0.45	0.45	0.46	0.47	0.48
.5	0.74	0.74	0.76	0.77	0.78	0.82
.7	1.03	1.04	1.06	1.08	1.10	1.11
.9	1.33	1.34	1.36	1.38	1.41	1.43
Area.	1.47	1.49	1.51	1.53	1.56	1.59
2	2.95	2.97	3.02	3.08	3.13	3.18
3	4.42	4.46	4.54	4.61	4.69	4.77
4	5.89	5.94	6.05	6.15	6.26	6.35
5	7.37	7.43	7.56	7.69	7.82	7.95
6	8.84	8.92	9.07	9.23	9.39	9.54
7	10.31	10.40	10.58	10.77	10.94	11.12
8	11.79	11.89	12.12	12.30	12.51	12.71
9	13.26	13.37	13.61	13.84	14.08	14.31
10	14.73	14.86	15.12	15.38	15.64	15.90
11	16.21	16.35	16.65	16.92	17.21	17.50
12	17.68	17.83	18.14	18.46	18.77	19.08
13	19.15	19.32	19.66	19.99	20.34	20.68
14	20.63	20.81	21.17	21.50	21.90	22.27
15	22.10	22.29	22.68	23.07	23.47	23.86
16	23.57	23.78	24.19	24.61	25.03	25.45
17	25.05	25.26	25.70	26.15	26.59	27.04
18	26.52	26.75	27.22	27.62	28.16	28.63
19	27.99	28.24	28.73	29.22	29.72	30.22
20	29.47	29.72	30.24	30.76	31.29	31.81
21	30.94	31.21	31.75	32.30	32.85	33.41
22	32.41	32.69	33.26	33.84	34.32	35.00
23	33.89	34.18	34.78	35.38	35.93	36.59
24	35.36	35.67	36.29	36.91	37.55	39.18
25	36.83	37.15	37.88	38.45	39.11	39.77
26	38.31	38.64	39.31	39.99	40.67	41.36
27	39.78	40.12	40.82	41.53	42.24	42.95
28	41.25	41.61	42.34	43.07	43.80	44.54
29	44.73	43.10	43.85	44.66	45.37	46.14
30	44.20	44.58	45.86	46.14	46.93	47.73

Cylinders *in Ale Gallons.*

	24	.1	.3	.5	.7	.9
.1	0.15	0.15	0.16	0.17	0.17	0.17
.3	0.43	0.46	0.49	0.50	0.51	0.52
.5	0.80	0.81	0.82	0.84	0.85	0.86
.7	1.12	1.13	1.15	1.17	1.19	1.21
.9	1.44	1.46	1.48	1.50	1.53	1.55
Area.	1.60	1.66	1.64	1.67	1.70	1.73
2	3.21	3.23	3.29	3.34	3.40	3.47
3	4.81	4.85	4.93	5.02	5.10	5.18
4	6.42	6.47	6.58	6.69	6.80	6.91
5	8.02	8.09	8.22	8.36	8.50	8.63
6	9.63	9.71	9.87	10.03	10.19	10.36
7	11.23	11.32	11.51	11.70	11.89	12.09
8	12.83	12.94	13.16	13.37	13.59	13.81
9	14.44	14.56	14.80	15.05	15.29	15.54
10	16.04	16.18	16.45	16.72	16.99	17.27
11	17.65	17.79	18.09	18.39	18.69	18.99
12	19.25	19.41	19.74	20.06	20.39	20.72
13	20.85	21.03	21.38	21.73	22.09	22.45
14	22.46	22.65	23.03	23.40	23.79	24.18
15	24.06	24.26	24.67	25.08	25.49	25.90
16	25.67	25.88	26.31	26.75	27.19	27.63
17	27.27	27.50	27.96	28.42	28.88	29.36
18	28.88	29.12	29.60	30.09	30.58	31.08
19	30.48	30.73	31.25	31.76	32.28	32.26
20	32.08	32.35	32.89	33.44	33.98	34.54
21	33.69	33.97	34.54	35.11	35.68	36.26
22	35.29	35.59	38.18	36.78	37.38	37.99
23	36.90	37.20	37.83	38.45	39.03	39.72
24	38.50	28.82	39.87	40.12	40.78	41.41
25	40.10	40.44	41.12	41.79	42.48	43.17
26	41.71	42.06	42.76	43.47	44.18	44.90
27	43.31	43.68	44.41	45.14	45.88	46.62
28	44.92	45.29	46.05	46.81	47.57	48.35
29	46.52	46.91	47.70	48.48	49.27	50.08
30	48.13	48.53	49.34	50.95	50.97	51.80

Cylinders *in Ale-Gallons*.

	.25	.1	.3	.5	.7	.9
.1	0.17	0.18	0.18	0.18	0.18	0.19
.3	0.52	0.53	0.53	0.54	0.35	0.56
.5	0.87	0.88	0.89	0.91	0.92	0.93
.7	1.22	1.23	1.29	1.27	1.29	1.31
.9	1.57	1.51	1.60	1.63	1.65	1.68
Area.	1.74	1.75	1.78	1.81	1.84	1.87
2	3.48	3.51	3.57	3.91	3.97	4.03
3	5.22	5.26	5.35	5.87	5.96	6.05
4	6.96	7.02	7.13	7.82	7.94	8.06
5	8.70	8.77	8.91	9.78	9.93	10.08
6	10.44	10.53	10.70	11.73	11.91	12.09
7	12.18	12.28	12.48	13.69	13.90	14.11
8	13.93	14.04	14.26	15.65	15.88	16.12
9	15.67	15.79	16.04	17.60	17.87	18.14
10	17.41	17.55	17.83	19.56	19.85	20.15
11	19.15	19.30	19.56	21.51	21.84	22.17
12	20.89	21.06	21.39	23.47	23.82	24.18
13	22.63	22.81	23.17	25.43	25.81	26.20
14	24.37	24.56	24.96	27.38	27.80	28.21
15	26.11	26.32	26.74	29.34	29.78	30.23
16	27.85	28.07	28.52	31.29	31.77	32.24
17	29.59	29.83	30.31	33.25	33.75	34.25
18	31.33	31.58	32.19	35.20	35.74	36.28
19	33.07	33.34	33.87	37.16	37.72	38.29
20	34.81	35.09	35.65	39.12	39.71	41.31
21	36.55	36.85	37.44	41.07	41.69	42.34
22	38.30	38.60	39.22	43.03	43.68	44.34
23	40.04	40.36	41.00	44.98	45.66	46.36
24	41.78	42.11	42.78	46.94	47.65	48.37
25	43.52	43.87	44.57	48.89	49.63	50.39
26	45.26	45.56	46.35	50.85	41.62	52.40
27	47.00	47.38	48.13	52.87	53.61	54.41
28	48.74	49.13	49.92	54.76	55.59	56.42
29	50.48	50.88	51.70	56.72	57.58	58.43
30	52.22	52.64	53.48	58.67	59.56	60.44

Cylinders *in Ale-Gallons.*

	.1	.3	.5	.7	.9
.1	0.19	0.19	0.20	0.20	0.20
.5	0.56	0.57	0.58	0.59	0.60	0.60
.5	0.94	0.95	0.96	0.98	0.99	1.01
.7	1.32	1.33	1.35	1.37	1.39	1.41
.9	1.61	1.71	1.73	1.76	1.76	1.81
Area.	1.88	1.90	1.93	1.96	1.99	2.01
2	3.77	3.79	3.85	3.91	3.97	4.03
3	5.65	5.69	5.78	5.87	5.96	6.05
4	7.53	7.19	7.71	7.82	7.94	8.06
5	9.41	9.49	9.63	9.78	9.93	10.08
6	11.30	11.38	11.59	11.73	11.91	12.09
7	13.18	13.28	13.48	13.69	13.90	14.11
8	15.06	15.[illegible]	15.41	15.65	15.88	16.12
9	16.94	27.09	[illegible]34	17.60	17.87	18.14
10	18.83	18.97	[illegible]26	19.56	19.85	20.15
11	20.71	20.87	21.19	21.51	21.84	22.17
12	22.59	22.77	23.12	23.47	23.82	24.18
13	24.47	24.66	25.04	25.43	25.81	26.20
14	26.36	26.56	26.97	27.38	27.80	28.21
15	28.24	28.46	28.90	29.34	29.78	30.23
16	30.12	30.35	30.82	31.29	31.77	32.24
17	32.01	32.25	32.75	33.25	33.75	34.26
18	33.89	34.15	34.67	35.20	35.74	36.28
19	35.77	36.05	36.60	37.16	37.72	38.29
20	37.65	37.94	38.53	39.12	39.71	40.31
21	39.54	39.84	40.45	41.07	41.69	42.32
22	41.42	41.74	42.38	43.03	43.68	44.34
23	43.30	43.64	44.31	44.98	45.66	46.35
24	45.18	45.53	46.23	46.94	47.62	48.37
25	47.07	47.43	48.16	48.89	49.63	50.38
26	48.95	49.33	50.09	50.85	51.62	52.40
27	50.83	51.22	52.01	52.81	53.61	54.41
28	52.72	53.12	53.94	54.76	55.59	56.43
29	54.60	55.02	55.87	56.72	57.58	58.44
30	6.18	56.92	57.79	58.67	59.56	60.46

Cylinders *in Ale Gallons.*

	27	.1	.3	.5	.7	.9
.1	0.20	0.20	0.21	0.21	0.21	0.22
.3	0.01	0.61	0.62	0.63	0.64	0.65
.5	1.01	1.02	1.04	1.05	1.07	1.08
.7	1.42	1.43	1.45	1.47	1.50	1.52
.9	1.83	1.84	1.87	1.90	1.92	1.96
Area.	2.03	2.05	2.08	2.11	2.14	2.17
2	4.06	4.09	4.15	4.21	4.27	4.34
3	6.09	6.14	6.23	6.32	6.41	6.50
4	8.12	8.18	8.40	8.42	8.55	8.67
5	10.15	10.23	10.38	10.53	10.68	10.84
6	12.18	12.27	12.45	12.64	12.82	13.01
7	14.21	14.32	15.53	14.74	14.36	15.17
8	16.24	16.36	16.61	16.85	17.10	17 34
9	18.27	18.41	18.68	.96	19.23	19.51
10	20.13	20.45	20.7	21.06	21.37	21.68
11	22.33	22.50	22.83	23.17	23.57	23.85
12	24.36	24.54	24.91	25.27	25.64	26.01
13	26.39	26.59	26.98	27.38	27.78	28.18
14	28.42	28.64	29.06	29 49	29.92	30.35
15	30.45	30.68	31.14	31.59	32.05	32.52
16	32.48	32.73	33.21	33.70	34.19	34.69
17	34.51	34.77	35.29	35.81	36.33	36.85
18	36.55	36.82	37.36	37.91	38.47	39.02
19	38.58	38.86	39.44	40.02	40.60	41.19
20	40.61	40.91	41.51	42.12	42.74	43.36
21	42.64	42.95	43.59	44.23	44.88	45.53
22	44.67	45.00	45.67	46.34	47.01	47.69
23	46.70	47.04	47.74	48.44	49.15	49.86
24	48.75	49.06	49.82	50.55	51.29	52.03
25	50.76	51.13	51.89	52.66	53.4-	54.20
26	52.79	53.18	53.91	54.76	55.56	56.37
27	54.82	55.23	56.04	56.87	57.70	58.53
28	56.85	57.29	58.12	58.97	59.84	60.70
29	58.88	59.32	60.19	61.08	61.97	62.81
30	60.91	61.36	62.29	63.19	64.11	65.05

Cylinders *in Ale-Gallons.*

	.28	.1	.3	.5	.7	.9
.1	0.22	0.22	0.22	0.23	0.23	0.23
.3	0.65	0.66	0.67	0.68	0.69	0.70
.5	1.09	1.10	1.11	1.13	1.95	1.16
.7	1.53	1.54	1.56	1.58	1.61	1.63
.9	1.96	1.98	2.01	2.04	2.06	2.09
Area.	2.18	2.20	2.23	2.26	2.29	2.33
2	4.37	4.40	4.49	4.52	4.59	4.65
3	6.55	6.60	6.69	6.79	6.88	6.98
4	8.73	8.80	8.92	9.05	9.18	9.30
5	10.92	11.00	11.15	11.31	11.47	11.63
6	13 10	13.19	13.38	13.57	13.76	13.96
7	15.28	15.39	15.61	15.83	16.06	16.28
8	17.47	17.59	17.84	18.10	18 35	18.61
9	19.65	18.79	20.07	20.36	20.65	20.93
10	21.83	21.99	22.31	22.62	22.94	23.26
11	24.02	24.19	24.54	24.88	25.23	25.59
12	26.20	26 39	26.77	27.15	27.53	27.91
13	28.39	28.59	29.00	29.41	29.82	30.24
14	30.57	30.79	31.23	31.67	32.12	32.57
15	32.75	32.99	33.46	33.93	34.41	34.89
16	34.94	35.18	35.69	36.19	36.71	37.22
17	37.12	37.38	37.92	38.46	39.00	39.54
18	39.30	39.58	40.15	40.72	41.29	41.87
19	41.49	41.78	42.38	42.98	43.59	44.20
20	43.67	43.98	44.61	45.24	45.88	46.52
21	45.85	46.18	46.84	47.51	48.18	48.85
22	48.04	48.38	49.87	49.77	50.47	51.17
23	50.22	40.58	51.30	52.03	52.76	53.50
24	52.40	52.78	53.53	54.29	55.06	55.83
25	54.59	54.98	55.76	56.55	57.35	58.15
26	56.77	57.18	58.00	58.82	59.65	60.48
27	58.95	59.38	60.23	61.08	61.94	62.80
28	61.14	61.57	62.46	63.34	64.23	65.13
29	63.32	63.77	64.69	65.60	66.53	67.46
30	65.50	65.94	66.92	67.87	68.82	69.78

Cylinders *in Ale Gallons.*

	29	.1	.3	.5	.7	.9
.1	0.23	0.24	0.24	0.24	0.25	0.25
.3	0.70	0.71	0.72	0.73	0.75	0.75
.5	1.17	1.18	1.19	1.21	1.23	1.24
.7	1.64	1.65	1.67	1.70	1.72	1.74
.2	2.17	2.12	2.15	2.18	2.21	2.24
Area.	2.34	2.36	2.39	2.42	2.46	2.49
2	4.68	4.72	4.78	4.85	4.91	4.98
3	7.03	7.07	7.17	7.27	7.37	7.47
4	9.37	9.43	9.56	9.69	9.83	9.96
5	11.71	11.79	11.95	12.12	12.29	12.45
6	14.05	14.15	14.35	14.54	14.74	14.94
7	16.40	16.51	16.74	16.97	17.20	17.43
8	18.74	18.87	19.13	19.39	19.65	19.92
9	21.08	21.23	21.52	21.81	22.11	22.41
10	23.42	23.58	23.91	24.24	24.57	24.90
11	25.76	25.94	26.30	26.66	27.02	27.39
12	28.11	28.30	28.69	29.08	29.48	29.88
13	30.45	30.66	31.08	31.51	31.94	32.37
14	32.79	33.02	33.47	33.93	34.39	34.86
15	35.13	35.38	35.86	36.35	36.85	37.35
16	37.48	37.73	38.26	38.78	39.31	39.84
17	39.82	40.09	40.65	41.20	41.76	42.33
18	42.16	42.45	43.04	43.63	44.22	44.82
19	44.50	44.81	45.43	46.05	46.68	47.31
20	46.85	47.17	47.02	48.47	49.13	49.80
21	49.19	49.53	50.21	50.90	51.59	52.29
22	51.53	51.88	52.60	53.32	54.05	54.78
23	53.87	54.24	44.99	55.74	56.50	57.27
24	56.21	56.60	57.38	58.17	58.96	59.76
25	58.56	58.96	59.77	60.59	61.42	62.25
26	60.90	61.32	62.17	63.02	63.87	64.74
27	63.24	63.68	64.57	65.44	66.33	67.23
28	65.58	66.03	66.95	67.86	68.79	69.72
29	67.93	68.39	69.34	70.29	71.24	72.21
30	70.27	70.75	71.73	72.71	73.70	74.71

Cylinders *in Ale Gallons.*

	30	.1	.3	.5	.7	.9
.1	0.25	0.25	0.26	0.26	0.26	0.27
.3	0.75	0.76	0.77	0.78	0.79	0.80
.5	1.25	1.26	1.28	1.29	1.31	1.33
.7	1.75	1.77	1.79	1.81	1.84	1.85
.9	2.26	2.27	2.30	2.33	2.36	2.39
Area.	2.51	2.52	2.56	2.59	2.62	2.66
2	5.01	5.05	5.11	5.18	5.25	5.32
3	7.52	7.57	7.67	7.77	7.87	7.98
4	10.30	10.09	10.23	10.36	10.50	10.64
5	12.53	12.62	12.78	12.95	13.12	13.30
6	15.04	15.14	15.34	15.54	15.75	15.95
7	17.55	17.66	17.90	18.14	18.37	18.61
8	20.05	20.19	20.45	20.73	21.00	21.27
9	22.56	22.71	23.01	23.32	23.62	23.93
10	25.07	25.23	25.57	25.91	26.25	26.59
11	27.57	27.76	28.13	28.50	28.87	29.25
12	30.08	30.28	30.38	31.09	31.50	31.91
13	32.59	32.80	33.24	33.68	34.12	34.57
14	35.09	35.83	35.80	36.27	36.75	37.23
15	37.60	37.85	38.35	38.86	39.37	39.89
16	40.11	40.37	40.91	41.45	42.00	42.55
17	42.61	42.90	43.47	44.04	44.62	45.21
18	45.12	45.42	46.03	46.63	47.25	47.87
19	47.62	47.94	48.58	49.22	49.87	50.52
20	50.13	50.47	51.14	51.82	52.50	53.18
21	52.64	52.99	53.70	54.41	55.12	55.84
22	55.14	55.51	56.25	57.00	57.75	58.50
23	57.65	58.04	58.81	59.59	60.37	61.16
24	60.16	60.56	61.37	62.18	63.00	63.82
25	62.66	63.08	63.92	64.77	65.62	66.48
26	65.17	65.61	66.48	67.36	68.25	69.14
27	67.68	68.13	69.04	69.95	70.87	71.80
28	70.18	70.65	71.60	72.54	73.50	74.46
29	72.69	73.18	74.15	75.13	76.12	77.12
30	75.50	75.70	76.71	77.72	78.75	79.78

Cylinders *in Ale Gallons.*

	31.	.1	.3	.5	.7	.9
.1	0.27	0.27	0.27	0.28	0.28	0.28
.3	0.80	0.81	0.82	0.83	0.56	0.85
.5	1.34	1.35	1.36	1.38	1.12	1.42
.7	1.87	1.89	1.91	1.93	1.68	1.98
.9	2.41	2.42	2.42	2.49	2.24	2.55
Area.	2.68	2.69	2.73	2.76	2.80	2.83
2	5.35	5.39	5.45	5.53	5.60	5.67
3	8.03	8.08	8.19	8.29	8.40	8.50
4	10.71	10.77	10.91	11.05	11.19	11.34
5	13.38	13.47	13.64	13.82	13.99	14.17
6	16.06	16.16	16.37	16.58	16.79	17.00
7	18.73	18.86	19.10	19.34	19.59	19.84
8	21.41	21.51	21.84	22.11	22.39	22.67
9	24.09	24.24	24.56	24.87	25.19	25.51
10	26.76	26.94	27.28	27.63	27.99	28.34
11	29.44	29.63	30.01	30.40	30.79	31.17
12	32.12	33.32	32.74	33.16	33.58	34.01
13	34.79	35.02	35.47	35.93	36.38	36.84
14	37.47	37.71	38.20	38.69	39.18	39.68
15	40.15	40.41	40.93	41.45	41.93	42.51
16	42.82	43.10	43.66	44.22	44.78	45.35
17	45.50	45.79	46.38	46.98	47.58	48.18
18	48.18	48.49	49.11	49.74	50.38	51.01
19	50.85	51.18	51.94	52.51	53.17	53.85
20	53.53	53.87	54.57	55.27	55.97	56.68
21	56.21	56.57	57.30	58.03	58.77	59.52
22	58.88	59.26	60.03	60.60	61.57	62.35
23	61.56	61.95	62.76	63.56	64.57	65.18
24	64.24	64.65	65.48	66.32	67.17	68.02
25	66.91	67.34	68.21	69.09	69.37	70.85
26	69.59	70.04	70.94	71.85	72.77	73.69
27	72.26	72.73	73.67	74.61	75.56	76.52
28	74.94	75.42	76.40	77.36	78.36	79.35
29	77.62	78.12	79.13	80.14	81.16	82.19
30	80.29	80.81	81.85	82.90	83.96	85.02

Cylinders *in Ale-Gallons.*

	.32.	.1	.3	5.	.7	.9
.1	0.28	0.29	0.29	0. 9	0.30	0.30
.3	0.86	0.86	0.87	0.88	0.89	0.90
.5	1.43	1.43	1.45	1.47	1.49	1.51
.7	2.00	2.01	2.03	2.06	2. 8	2.11
.9	2.57	2.58	2.07	2.65	2.6	2.71
Area.	2.85	2.87	2.91	2.94	2.98	3.01
2	5.79	5.74	5.81	5.88	5.96	6.03
3	8.56	8.61	8.72	8.82	8.93	9.04
4	11.41	11.48	11.62	11.77	11.91	12.06
5	14.25	14.35	14.53	14.71	14.89	15.07
6	17.11	17.22	17.42	17.65	17.87	18.09
7	19.96	20.09	20.34	20.59	20.85	21.10
8	22.81	22.96	23.25	23.53	23.82	24.12
9	25.87	25.83	26.15	26.48	26.80	27.13
10	28.52	28.70	29.06	29.42	29.78	30.15
11	31.37	31.57	31.96	32.36	32.76	33.16
12	34.22	34.44	34.87	35.30	35.74	36.17
13	37.07	37.31	37.77	38.24	38.71	39.19
14	39.93	40.18	40.68	41.18	41.69	42.20
15	42.78	43.05	43.58	44.13	44.67	45.22
16	45.63	45.92	46.49	47.07	47.65	48.23
17	48.58	48.79	47.40	50.01	50.63	51.25
18	51.33	51.66	52.30	52.95	53.61	54.26
19	54.19	54.53	55.21	55.89	56.58	57.28
20	57.04	57.40	58.11	58.84	59.56	60.29
21	59.89	60.27	61.02	61.78	62.54	63.31
22	62.74	63.14	63.92	64.72	65.52	66.32
23	65.59	66.00	66.83	67.66	68.50	69.34
24	68.45	68.87	69.74	70.60	71.47	72.35
25	71.30	71.74	72.64	73.54	74.45	75.36
26	74.15	74.61	75.55	76.49	77.43	78.38
27	77.00	77.48	78.45	79.43	8 .41	81.39
28	79.85	80.35	81.36	82.37	83.39	84.41
29	82.70	83.22	84.26	85.31	86.36	87.42
30	85.56	86.09	87.17	88.25	89.34	90.44

Cylinders *in Ale-Gallons.*

	33	.1	.3	.5	.7	.9
.1	0.30	0.30	0.31	0.31	0.32	0.32
.3	0.91	0.91	0.93	0.94	0.95	0.96
.5	1.52	1.53	1.54	1.56	1.58	1.60
.7	1.12	2.14	2.16	2.19	2.23	2.24
.9	2.13	2.75	2.78	2.81	2.86	2.88
Area.	3.03	3.05	3.09	3.13	3.16	3.20
2	6.07	6.10	6.18	6.25	6.33	6.40
3	9.10	9.15	9.26	9.38	9.49	9.60
4	12.13	12.21	12.35	12.50	12.65	12.80
5	15.16	15.26	15.44	15.63	15.81	16.00
6	18.20	18.31	18.53	18.75	18.98	19.20
7	21.23	21.36	21.62	21.88	22.14	22.40
8	24.26	24.41	24.71	25.00	25.30	25.61
9	27.30	27.46	27.80	28.13	28.47	28.81
10	30.33	30.51	30.88	31.26	31.61	32.01
11	33.36	33.56	36.97	34.38	34.79	35.21
12	36.40	36.62	37.06	37.51	37.96	38.41
13	39.43	39.67	40.15	40.63	41.12	41.61
14	42.64	42.72	43.24	43.76	44.28	44.81
15	45.49	45.77	46.33	46.88	47.44	48.01
16	48.53	48.82	49.41	50.10	50.61	51.21
17	51.56	51.80	52.50	53.13	53.71	54.41
18	54.59	54.93	55,59	56.26	56.93	57.61
19	57.63	57.89	58.68	59.39	60.10	60.81
20	60.66	61.30	61.77	62.51	63.26	64.01
21	63.69	64.08	64.86	65.64	66.43	67.21
22	66.73	67.13	67.94	68.76	69.59	70.41
23	69.70	70.18	71.30	71.81	72.75	73.62
24	72.79	73.23	74.12	75.01	75.91	76.82
25	75.82	76.28	77.21	78.14	79.08	80.02
26	78.86	80.34	80.30	81.27	82.24	83.22
27	81.89	82.39	83.39	84.39	85.40	86.42
28	84.92	85.44	86.47	87.52	88.57	89.66
29	87.96	83.49	89.56	90.64	91.73	92.82
30	90.99	91.54	92.65	93.77	94.89	96.02

Cylinders *in Ale Gallons.*

	34	·1	·3	·5	·7	·9
·1	0.32	0.32	0.33	0.33	0.33	0.34
·3	0.97	0.97	0.98	0.99	1.01	1.02
·5	0.61	1.62	1.64	1.66	1.68	1.70
·7	2.25	2.27	2.29	2.32	2.35	2.37
·9	2.90	2.91	2.95	2.98	3.08	3.05
Area.	3.22	3.24	3.28	3.31	3.35	3.39
2	6.44	6.48	6.55	6.63	6.71	6.78
3	9.66	9.72	9.83	9.94	10.06	10.18
4	12.88	12.45	13.11	13 16	13.41	13.57
5	16.10	16.19	16.38	16.57	16.77	16.96
6	19.32	19.43	19.66	19.89	20.12	20.35
7	22.54	22.67	22.94	23.20	23.47	23.75
8	25.76	25.91	26.21	26.52	26.83	27.14
9	28.98	26.15	29.49	29.83	30.18	30.53
10	32.20	32.38	32.77	33.15	33.58	33.92
11	35.42	35.62	36.04	36.46	36.89	37.31
12	38.63	38.86	39.32	39.78	40.24	40.71
13	41.85	42.10	42.60	43.09	43.60	44.10
14	45.07	45.34	45.87	46.41	46.95	47.49
15	48.09	48.58	49.15	49.72	50.30	50.88
16	51.41	51.82	52.43	53.04	53.65	54.28
17	54.73	55.05	55.70	56.35	57.01	57.67
18	57.95	58.29	58.98	59.67	60.36	61.06
19	61.17	61.53	62.25	62.98	63.72	64.45
20	64.39	64.77	65.53	66.30	67.07	67.85
21	67.61	68.01	68.81	69.61	70.42	71.24
22	70.83	71.25	72.08	72.93	73.18	74.64
23	74.05	74.44	75.36	76.24	77.13	78.03
24	77.27	77.72	78.64	79 56	80.48	81.42
25	80.49	80.96	81.91	82.87	83.84	84.81
26	83.71	84.20	85.19	89.19	87.19	88.21
27	86.93	87.44	88.47	89.50	90.54	91.59
28	90.15	90.68	91.74	92.82	93.90	94.98
29	93.37	93.92	95.02	96.13	97.25	98.37
30	96.59	97.15	98.30	99.45	100.60	101.76

	.35	1.	.3	5.	.7	.9
.1	0.34	0.34	0.35	0.35	0.35	0.36
.3	1.02	1.03	1.04	1.05	1.06	1.08
.5	1.71	1.72	1.73	1.75	1.77	1.79
.7	2.39	2.40	2.43	2.46	2.48	2.51
.9	3.07	3.09	3.12	3.16	3.19	3.23
Area	3.41	3.43	3.12	3.51	3.55	3.59
2	6.82	6.86	6.94	7.02	7.10	7.18
3	10.23	10.29	10.41	10.53	10.65	10.77
4	13.65	13.72	13.88	14.04	14.20	14.36
5	17.06	17.16	17.35	17.55	17.75	17.95
6	20.47	20.59	20.82	21.06	21.30	21.54
7	23.88	24.02	24.29	24.57	24.85	25.13
8	27.2	27.45	27.76	28.08	28.40	28.72
9	30.7	30.88	31.23	31.59	31.95	32.30
10	34.12	34.31	34.70	35.10	35.50	35.89
11	37.53	37.74	38.17	38.61	39.05	39.48
12	40.94	41.18	41.65	42.12	42.59	43.07
13	44.35	44.61	45.12	45.63	46.14	46.66
14	47.76	48.04	48.59	49.14	49.69	50.25
15	51.76	51.47	52.06	52.65	53.24	53.84
16	54.59	54.90	55.53	56.16	56.79	57.43
17	58.00	58.33	59.00	59.67	60.34	61.02
18	61.41	61.76	62.47	63.18	63.89	64.61
19	64.82	65.20	65.94	66.69	67.44	68.20
20	68.23	68.63	69.41	70.20	70.99	71.79
21	71.65	72.06	72.88	73.71	74.54	75.38
22	75.06	75.49	76.35	77.22	78.09	78.97
23	78.47	78.92	79.82	80.73	81.64	82.56
24	81.88	82.35	83.29	84.24	85.19	86.15
25	85.29	85.78	86.76	87.75	88.74	89.74
26	88.70	89.21	90.23	91.26	92.29	93.33
27	92.12	92.64	93.70	94.77	95.84	96.92
28	95.53	96.08	97.17	98.28	99.36	100.51
29	98.94	99.51	100.64	101.79	102.94	104.09
30	102.35	102.94	104.11	105.30	106.49	107.68